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ABSTRACT

This document is the fifth educational packet in the Alaska Wildlife Week Series. This unit emphasizes forest wildlife, ecology, and conservation and includes: a teacher's guide with information, interdisciplinary activities, games, and worksheets; a wildlife poster; forest wildlife cards with illustrations and text describing over 100 organisms that live in Alaska's forest; a forest learning trail with guidelines for setting up a nature trail in a forested site near schools in Alaska; and a forest game for review and reinforcement of the concepts and vocabulary. The material is organized so that each of the five lessons builds upon those previous. An introductory activity is suggested for each lesson to be used along with any of the wide variety of the activities for curriculum integration that are provided. This thematic teaching approach integrates science, language arts, social studies, math, art, and other subjects. The worksheets may be used to review, reinforce, or evaluate student understanding of the lessons. (CW)

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Alaska Wildlife Week 1987
Introduction

Alaska's Forests--More Than Just Trees is the fifth educational packet in the Alaska Wildlife Week Series developed by the Alaska Department of Fish and Game, Game Division--Nongame Wildlife Program. These educational materials are intended for use throughout Alaska, including non-forested areas. This 1987 unit emphasizes forest wildlife, ecology, and conservation.

This comprehensive forest unit includes: A Teacher's Guide--full of information, interdisciplinary activities, games, and worksheets; A Wildlife Poster; Forest Wildlife Cards--illustrations and text about over 100 organisms that live in in Alaska's forests; A Forest Learning Trail--a guidebook to setting up a Nature Trail in a forested site near your school, A Forest Game--for review and reinforcement of the concepts and vocabulary covered in this unit; and a 5-part filmstrip series. This filmstrip series, which supplements each of the 5 lessons in the Teacher's Guide, will aid you and students in visualizing Alaska's forest environments as well as in understanding the concepts of the unit.

The Teacher's Guides are organized so that each of 5 lessons on forests builds upon those previous. An introductory activity is suggested for each lesson; use these along with any of the wide variety of the Activities for Curriculum Integration that are provided. This thematic teaching approach integrates science, language arts, social studies, math, art, and other subjects. Easy-to-duplicate worksheets may be used to review, reinforce, or evaluate student understanding of the lessons. Please feel free to adapt and modify activities and worksheets to best suit your teaching style, students' learning styles, and your location and situation. Three separate Teacher's Guides were prepared--one each for Primary (K-3), Upper Elementary (4-6), and Junior/Senior High (7-12)--be sure you have the one that best matches your students' knowledge and thinking skills.

As always, we encourage you to integrate Alaska Wildlife Week with other conservation education materials available in Alaska. The Reference List at the end of this guide provides a list of many teaching materials relevant to this unit on forests, as well as information on how to obtain the materials.

1987 marks the fifth year of Alaska Wildlife Week, an annual celebration of the variety and abundance of wildlife in Alaska and a time for learning about wildlife and conservation. The Alaska Department of Fish and Game began producing the Alaska Wildlife Week educational materials in 1982 in response to teacher requests for Alaska-specific materials on wildlife and conservation. Originally patterned after the National Wildlife Week educational effort sponsored by the National Wildlife Federation, Alaska Wildlife Week has evolved in response to teacher needs, requests, and evaluations. Although the themes and packets have changed annually, all remain relevant and interlock to some degree. You'll find that many of the Alaska Wildlife Week packets from previous years have information and activities relevant to this year's theme; the 1986 packet on ecosystems is particularly pertinent.

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ALASKA WILDLIFE WEEK. Primary Teacher's Guide

UNIT 5. Alaska's Forests--More Than Just Trees.

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Lesson / Objective	Teacher Background	Introductory Activity	Student Worksheets	Ideas for Curriculum Integration
1. FROM TREES TO FORESTS. Students will develop an awareness and appreciation of trees and forests.	7-8	9-10	11-12	13-14
2. THE FOREST TAPESTRY. Students will become familiar with the variety of organisms found in Alaskan forests.	15-16	17-27	28-29	30-31
3. FORESTS AND CHANGE. Students will understand some of the ways that living things in a forest are interdependent.	33-34	35-36	37-38	39
4. HOW MUCH IS A FOREST WORTH? Students will recognize that forests have many values.	41-42	43	44	45-46
5. FORESTS FOR THE FUTURE. Students will recognize that we must use Alaska's forests carefully to ensure that they continue to provide all the benefits we enjoy today.	47-48	49-51	52	53

Supplementary Materials That Accompany This Teacher's Guide

***A Color Poster**
Color photographs of Alaska's coastal and boreal forests and 12 kinds of forest wildlife.

****Forest Wildlife Cards**
Over 100 illustrated cards of common forest wildlife of Alaska, including birds, mammals, insects, invertebrates, fungi, plants, and microscopic organisms. (A simplifed version covering 34 species is included in the Primary Teacher's Guide.)

****A Forest Game**
More Than Just Trees--A Forest Game--board and cards for review of the concepts in this unit.

****A Forest Learning Trail**
20 pages of outdoor learning stations to guide students in discovery of a forest near your school.

****A Filmstrip Series** (Parts 3 and 5 are intended for use with students from grade 4 up.)
Five-part filmstrip series to introduce or review the material covered in each lesson of this guide; Includes: From Trees to Forests (7 minutes); The Forest Tapestry (18 minutes); Forests and Change (25 minutes); How Much Is A Forest Worth (11 minutes); and Forests For the Future (17 minutes)

*** Included with this guide. **One copy sent to each school library.**

List of Worksheets and Solutions

LESSON 1.

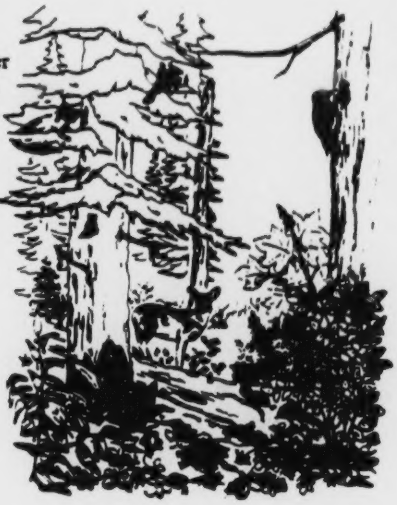
Worksheet 1a. Trees.
Students should draw squares around trees a, c, and d.
Students should draw circles around leaves a, b, and d.

Worksheet 1b. Alaska's Forests: self-explanatory.

LESSON 2.

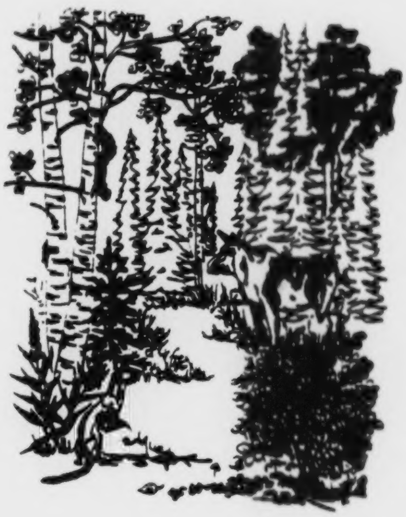
Worksheet 2a. Coastal Forest.
The following organisms are pictured:

red-breasted sapsucker.
deer mouse
red squirrel
wood frog
Sitka black-tailed deer
red-breasted nuthatch
marten
Steller's Jay
owl
hornet
banana slug
beetle
caterpillar
millipede
Devil's club
huckleberry
trailing raspberry
bunchberry
ferns
horsetails
skunk cabbage
twisted stalk
shelf fungi
mushroom
lichen



Worksheet 2b. Boreal Forest
The following organisms are pictured:

gray jay
red squirrel
brown creeper
ermine
beetle
centipede
shrew
butterfly
moose
kinglet
hairy woodpecker
owl
birch
spruce
fireweed
wild rose
twinflower
clubmoss
horsetails
shelf fungi
mushrooms
lichen



LESSON 3.

Worksheet 3a. Forest Food Chains. The number 1 should be placed in the circle next to the sun, air, water, and soil. The other numbers should be assigned as follows:
willows-2, hare-3, lynx-4, carrion beetle-5, springtail-5; spruce tree-2, crossbill-3, merlin-4, mushroom-5, flies-5.

Worksheet 3b. Symbiosis. Students should have matched the owl and woodpecker, the tree and mushroom, and the flower and bee.

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LESSON 4.

Worksheet 4. Forests provide, or help provide all of the items shown, so they should all be colored in. Confusion may arise over the question of fish in the forest; many fish live in streams that are sheltered by forests. The forests provide important nutrients, watershed protection, and resting areas.

LESSON 5.

Worksheet 5. Forest Friends: Students should place an X over littering and breaking off tree branches,. They should place a C over cutting down trees to get wood. They should color in using paper carefully and recycling, picking up litter, planting trees in disturbed areas, conserving energy, obeying forest rules, and preventing forest fires.

A FOREST GLOSSARY

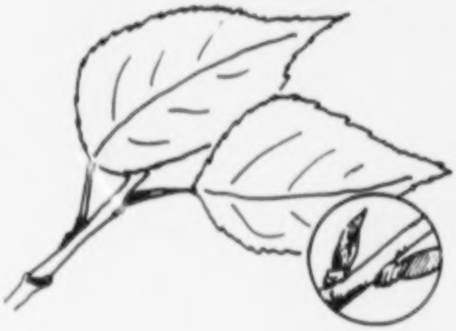
animal	All the organisms in one of the five great groups of living things. All animals are big enough to see easily. Most animals move around a lot and get food by eating other living things. Birds, mammals, fish, amphibians, reptiles, insects and other invertebrates are all animals.
bark	The dead, outer covering of tree trunks and branches that protects the tree from insects, fungi, and weather; the bark is formed as the phloem layer of the tree dies.
boreal forest	(bore-ee-ul) The forest of mixed conifers and hardwoods that occurs in northern areas around the world, including central Alaska.
carbon dioxide	A gas that most living things give off (breathe out). Plants and algae also take it in for photosynthesis.
coastal rain forest	The coniferous forest that occurs along the western coast of North America from Kodiak Island to northern California.
conifer	A kind of tree that has needle-like or awl-shaped leaves and forms its seeds inside cones; conifer seeds do not have a thick coating; the crown is cone-shaped or triangular ; most conifers do not shed their leaves in winter.
consumer	A living thing that gets energy and minerals by eating other living or dead things.
deciduous	(dee-sid-you-us) A tree that loses all of its leaves during some time of year, usually in fall.
ecosystem	(ee-co-sis-tem) The non-living surroundings plus all the living things in an area and their interactions.
energy	The force that causes objects to move.
food	Energy and minerals in a form living things can use.
food chain	The pathway of energy and minerals from the non-living surroundings to producers through consumers and back to the non-living surroundings.
food web	All the food chains in an ecosystem.
forest	Any ecosystem that contains many trees.
forester	A person who takes care of a forest; may also be called a forest manager.
forest manager	A person whose job is to take care of a forest; may also be called a forester
forest management	The balancing of use and protection of a forest to ensure that it will continue to provide desired benefits.
fungi	(fun-jee) One of the five great groups of living things. Most fungi do not move around, but instead, live their lives in one place. Most eat dead things and waste materials, but some obtain food through symbioses with plants or microscopic organisms. Fungi are often white, but may be very colorful.
habitat	The home of a living thing where it is able to find the right kinds and amount of food, cover, water, and space in the arrangement it needs to survive.

hardwood	A type of tree that has broad, flat leaves and flowers, and forms seeds with a thick outer coat.
hyphae	(high-fee) The tiny hair-like parts that form the main body of a fungi; hyphae are the part of a fungi that grow and feed.
living thing	Something that is able to move, grow, and make new things like itself; an organism. Living things are classified into five great groups, or kingdoms: monerans, protists, fungi, plants, and animals.
microscopic organisms	Living things too small to be seen without the use of a microscope; most are monerans or protists (a few fungi are microscopic); includes algae, bacteria, and protozoans.
minerals	The substances (elements and compounds) that make up living and non-living things.
monerans	(mo-nerr-ans) One of the five great groups of living things; includes only microscopic things like bacteria and blue-green algae; monerans do not have a cell nucleus.
non-living thing	Something that does not, and cannot, move, grow, and make new things like itself; air, water, soil and rocks, and energy are examples of non-living things.
non-renewable resource	A resource which is in limited supply and can not be reproduced after it is used; oil, coal, gas, and metals are examples of non-renewable resources.
oxygen	(ox-i-jen) The gas that most living things breathe in and need in order to live; plants and algae also give this gas off.
photosynthesis	(foto-sin-this-iss) The way that plants and algae change sunlight, water, and carbon dioxide into sugar and oxygen.
plant	One of the five great groups of living things; includes all the living things that have leaves, roots, and stems. Nearly all plants are green and live their lives without moving from place to place. Nearly all plants are producers.
producer	(pro-dew-sir) Any living thing that is able to make food from non-living things such as air, water, and soil; plants and algae are examples of producers.
protist	(pro-teest) One of the five great groups of living things; this group includes microscopic living things called protozoans, as well as microscopic, and large, algae and seaweeds.
renewable resource	A resource which occurs in limited supply, but which can be regrown or reproduced; wood is an example of a renewable resource because we can harvest and use trees, then grow new ones.
snag	A large, old dead or dying tree with at least partly rotted heartwood.
treeline	The edge of a forest that occurs wherever the environment becomes unsuitable for trees; such as at high elevations, in far northern areas, and at the edges of wetlands and deserts.
value	The worth or benefit of something.
watershed	All the land from which water drains into a single river.

Lesson 1.

Vocabulary

boreal forest, coastal rain forest, conifer, forest, hardwood, leaves, photosynthesis, roots,tree, treeline, trunk



Objectives:

Students will develop an awareness and appreciation of trees and forests.

Background:

Trees are among the largest living things on earth and live longer than most other living things. One of the largest Alaskan trees, the Sitka spruce, grows 200 feet tall, may live 700-800 or more years, and may weigh 40 tons.

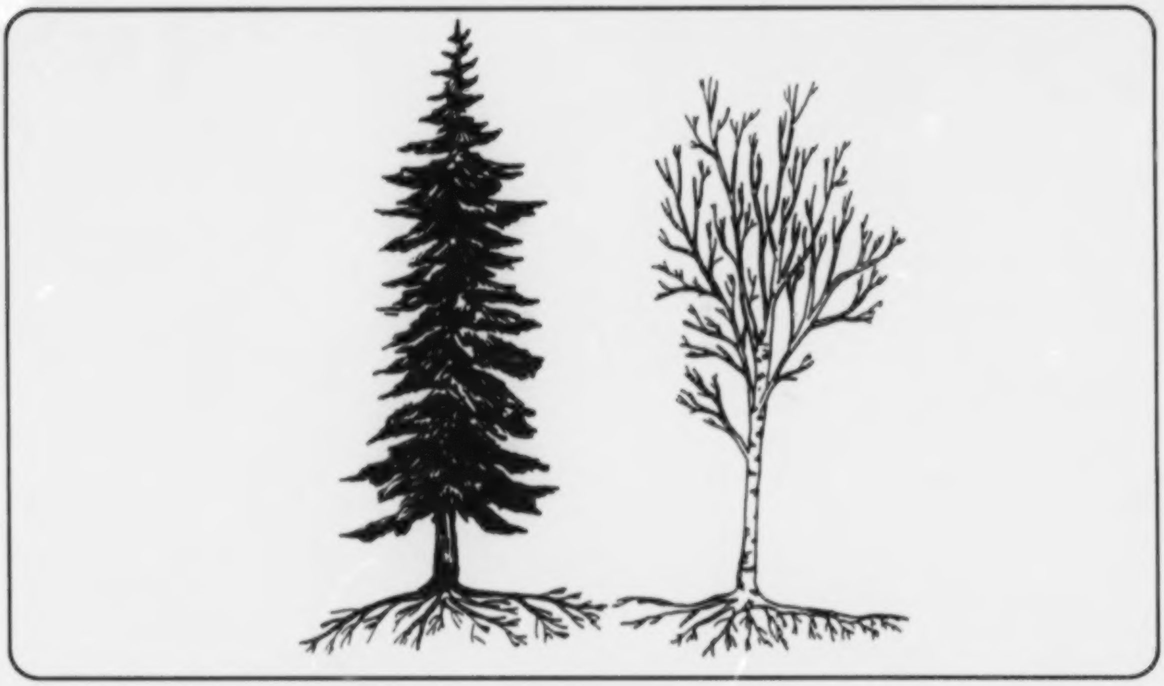
WHAT ARE TREES? They are plants, made up of leaves, woody stems and branches, and roots. Most trees have one large stem called a trunk. When you look at a tree, you see only about half of it; the underground roots are almost as large as the above ground parts. The roots of Alaskan trees spread out horizontally through the soil, rather than reaching down deep. Each part of the tree has an important function.

The ROOTS get water and minerals from the soil. The LEAVES are food factories; they combine sunlight (energy), carbon dioxide from the air, and water to make stored energy. This process is called photosynthesis. The TRUNK AND BRANCHES carry water and minerals from the roots to the leaves, and stored energy from the leaves to other parts of the tree.

KINDS OF TREES: There are two kinds of trees: conifers (sometimes called softwoods) and hardwoods. CONIFERS are trees with cone-shaped crowns; they are often used as Christmas trees. Their leaves are narrow and rounded and often look like needles. Their seeds grow inside cones. Most conifers keep their leaves all winter. Some of the conifers in Alaska are white, black, and Sitka spruce, western and mountain hemlock, Alaska cedar, western red cedar, tamarack, and lodgepole pine.

HARDWOODS are trees that have flowers. Some hardwoods have flowers that do not look like typical flowers, however. Different kinds of hardwoods have different kinds of leaves, but they are all flat; none are rounded or needle-shaped like those of conifers. Most hardwood trees are deciduous; that means they lose their leaves in the fall. However, some hardwoods in tropical areas are evergreen. Some of the hardwoods in Alaska are birch, aspen, balsam poplar, black cottonwood, crab apple, red alder, mountain ash, and red-osier dogwood.

Alaska Wildlife Week Unit 5. Alaska's forests. © 1987 ADF&G



WHERE DO TREES GROW? When many trees grow together, the area is called a FOREST. Many parts of the earth are covered by forests. Different kinds of trees grow in different climates and soils, so different kinds of forests occur in different parts of the world.

There are many places where the environment is too harsh for trees. Trees can not grow where there is too little rain or snow, or where it is too cold or hot; deserts, tundra, and prairies are places where it is too dry, and the temperatures are not suitable for trees to grow. Trees can not grow where there is too much water, either. Oceans and wetlands are places where it is too wet for most trees.

The places where forests end because the environment is too harsh are called TREELINES--the lines that trees can not grow beyond. Treelines occur in Alaska near the tops of mountains, at the edges of wetlands, and in the far north. Lack of moisture or too much, cold temperatures, and wind cause these treelines.

ALASKA'S FORESTS: Parts of two of the great northern forests occur in Alaska: the pacific coastal rain forest and the boreal forest.

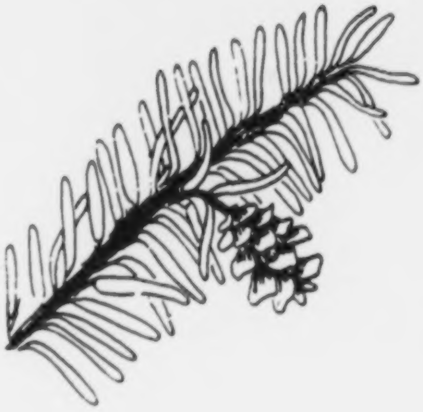
The PACIFIC COASTAL RAIN FOREST occurs along the coast from northern California to Kodiak Island. It is made up mainly of conifers, particularly western hemlock and Sitka spruce.

The BOREAL FOREST occurs in northern areas around the world, including central Alaska. It is made up of both hardwoods and conifers, the major species are white and black spruce, birch and aspen.

If you look closely at either of these forests, you will notice that the kinds of trees, their sizes and spacing vary from one place to another. This variation is partly caused by differences in the amount of sunlight received (north versus south slopes), the amount of moisture in the soil (well-drained or poorly drained), and the soil type.

FORESTS AFFECT THE ENVIRONMENT: Forests of trees return water to the air, and thus help to form clouds. They also break the wind, and clean and purify the air. Forests help build soil and prevent soil erosion. They also store water (in the soil). As this stored water seeps through the ground it refills streams and underground water supplies.

Introductory Activity 1



Objectives:

Students will practice listening skills and develop an awareness and appreciation of trees and forests of Alaska.

Materials:

Alaska Wildlife Week Filmstrip, Part 1, Dukane projector, or filmstrip projector and tape recorder; pictures and/or specimens of various tree species; Optional: access to an outdoor site with trees.

Procedure:

1. READ THE RIDDLE: Introduce the lesson by using the following riddle. Ask students to listen carefully and raise their hands when they think they know what the following riddle describes.

WHO AM I?

a. I make a bark, but am not a dog.
b. I have a trunk, but do not travel.
c. I have a crown, but am not a king.
d. I may leaf (out), but I do not move.
e. I root in the soil, but I am not a pig.
f. I live on a diet of sunshine, water, air, and minerals from the soil.
g. My kind are the largest living things on earth.
h. I weigh less than a dime when I am born (or begin my life), but I weigh many tons when I am grown.
i. Many people say they can't see the forest, because too many of me are in the way.
j. My name rhymes with see.

When most students in the class have raised their hands, ask someone to call out the answer. (A TREE).

2. STUDENTS EXAMINE PICTURES AND SPECIMENS OF DIFFERENT TREES. Explain to students that they are beginning a new unit on the study of these amazing living things--the largest living things on earth--living things that are able to live and grow just by standing in one place and taking in sunshine, air, water, and minerals from the soil. And, living things that live for hundreds of years. You may want to point out the sizes and ages of various trees. [The largest Alaskan tree is the Sitka spruce, it grows 200 feet tall, has a trunk 7-8 feet in diameter, and may weigh 40 tons. (A blue whale, the largest animal that has ever lived on earth, is only 100 feet long; however, it may weigh up to 100 tons.) The largest tree in North America is the giant sequoia, which grows 300 feet tall, may have a trunk 40 feet in diameter, and weigh up to 2000 tons.] Many trees that are still growing were already hundreds of years old when students' parents were born. (You may want to cite other dates that mean something to students--e.g. when Bering visited Alaska, Columbus discovered America, etc. The oldest trees in Alaska are cedars that grow in southeastern Alaska; some live over 1000 years. The oldest trees in North America (bristlecone pines from California) were seedlings when the Egyptians were building the pyramids some 4,900 years ago).

Have students go outside and look at trees, or examine pictures and specimens of trees in the classroom. Help them learn to recognize the crown, leaves, branches, trunk, and roots. Look at a stump or a cross-section of a tree that has been recently cut and count the annual rings to find out how old the tree was when it was cut. Compare the leaves and branches of conifers and hardwoods and help students classify these groups. Have students shake the seeds out of a cone.

4. SHOW THE ALASKA WILDLIFE WEEK FILMSTRIP, Part 1. From Trees to Forests. This has some words and concepts that will be new to students. You may want to preview it and decide whether you need to introduce your students to the terms before they watch it. However, it is not important that they learn the words in the filmstrip; they should gain a better understanding of what the different parts of a tree do, the differences between conifers and hardwoods, where trees do and do not grow, that many trees together form a forest, and two kinds of forest grow in Alaska. After the filmstrip is over, review these points to be sure that students understood them.

5. STUDENTS IMAGINE THEMSELVES TO BE TREES. (This activity will be most effective if students are outside--standing in a forest.) Ask students to stand up against the trunk of a tree, close their eyes, and imagine they are that tree. Guide them through a year as a tree, as you review the roles of the various parts of a tree, by reading the following paragraph:

Conifers: You are a conifer tree. Your cone-shaped crown stretches far upward into the sky. Your trunk is straight and strong--it must be to hold up your spirals of branches and your thousands of narrow needle-like leaves. Your roots are planted solidly in the cool soil. They stretch underground from your trunk as far outward as your trunk reaches skyward. They mingle in and among the roots of the other trees of your forest. Your roots are soaking up water and minerals from the soil. These are slowly drawn up through the inner layers of your trunk. You can feel the cool moisture traveling upward, then out your branches into your leaves. Your leaves are soaking up warm sunshine and the cool air. Tiny chemical factories inside your leaves are busily churning away--changing the sunshine, carbon dioxide from the air, and the water sent up from the roots into sugars, or food. These sugars travel out of your leaves. They slowly seep through the outer layers of your branches and trunk to reach the other parts of the tree. These sugars are food for the trunk so it can grow taller and stronger, food for your cones and the seeds that are forming inside, and they are food for the roots so they can grow longer and find more water and minerals. Day in and day out, your sap flows through your trunk, your leaves capture the energy of sunlight, and you grow taller. You grow new leaves, and you form new seeds and cones.

It has been a long summer. The air is beginning to be cooler, the wind is colder and it drys your leaves. Just as the thick bark on your trunk and branches protected you from the insects and hot sun, now it protects you from cold, dry winds. Some mornings there is frost creeping over your roots. Your sap is flowing more slowly and you slowly stop growing. Winter is coming. Your roots must hold you solidly to the ground as the winter winds howl and toss your branches in the wind. Your tall, strong trunk sways back and forth in the wind. Your branches are covered by heavy snows. They creak and sigh as the winds toss them. You must sleep and wait for warmer weather, more sunshine, and another season to grow. You have lived through 100 winters, this one too will pass. Months of cold and darkness pass before you feel spring arriving. Then, cold melt water begins to seep through the soil; your roots are awakened by the icy cold water. Your leaves begin to warm as the sunlight shines on them for longer hours. Then one morning, a bird perches in your branches and sings a warbled song. Spring has arrived, and another season of growth has begun. You begin adding another ring to your trunk, another layer of branches and leaves to your crown, and begin making another crop of cones.

(You can add to this, or change it to describe a hardwood tree. To do so, change the crown and leaf shape, and add in sentences about the loss of leaves in fall, and their regrowth in spring.)

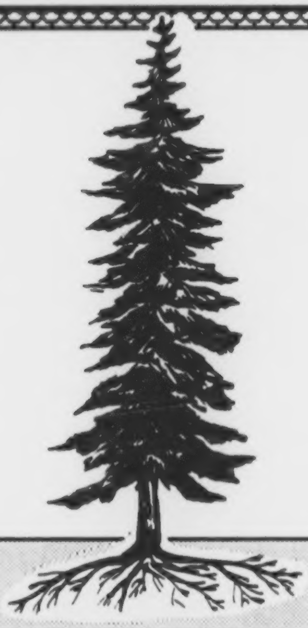
6. STUDENTS COMPLETE WORKSHEETS 1a and 1b. These worksheets are intended to reinforce the information presented on the differences between conifers and hardwoods, and the extent of the two types of forest in Alaska.

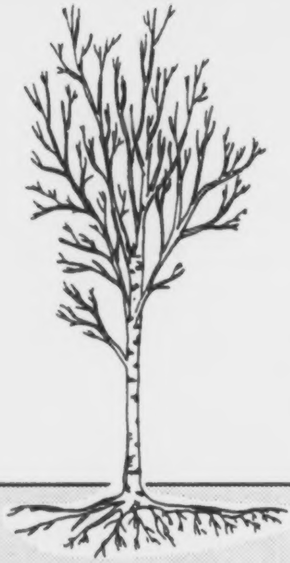
Primary

TREES Worksheet 1a

Name ______________________________

Color in these pictures of trees and read the information below. Then, answer the questions at the bottom of the page.



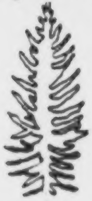


Conifers are trees that are shaped like upside-down cones. Conifers grow their seeds in cones. Their leaves are small, narrow, and look like needles.

Hardwoods are trees that grow their seeds in flowers. They have broad, flat leaves.

Some of the trees shown below are conifers and some are hardwoods. Draw a square around each of the conifer trees.

a.



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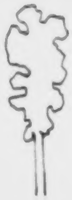

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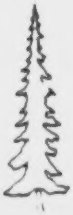

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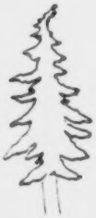
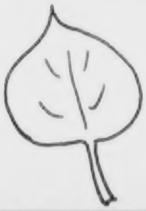


Some of the leaves below are from conifers and some are from hardwoods. Circle the leaves that come from hardwood trees.

a.



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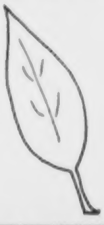

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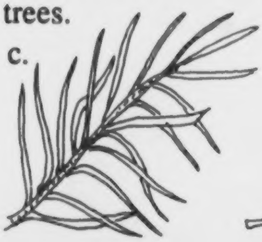
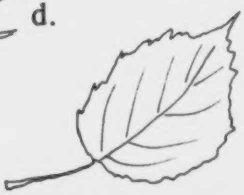


d.



Alaska Wildlife Week Unit 5: Forests © 1987

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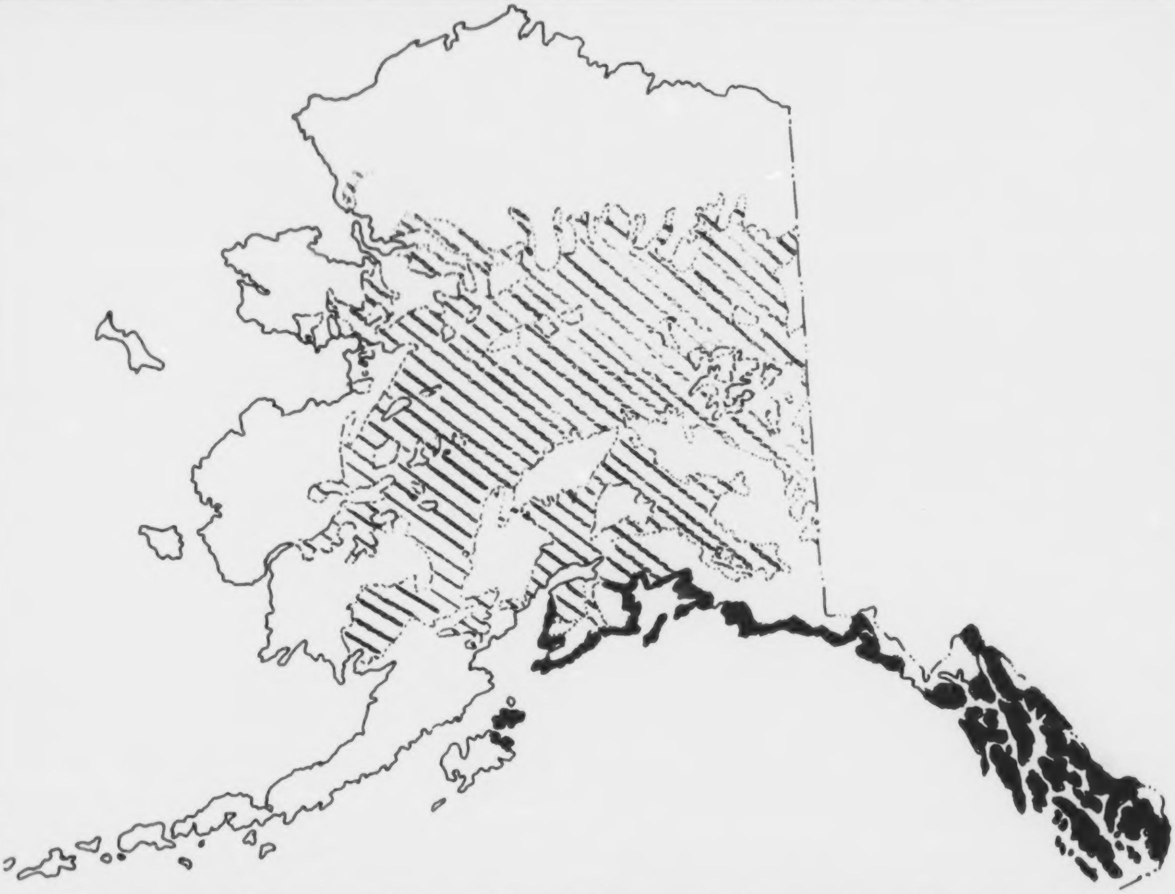
Primary

Alaska's Forests Worksheet 1b

Name ______________________________



This is a map of our state, Alaska. The white areas on the map show the parts of Alaska where forests do not grow. The black areas on the map show the parts of Alaska covered by the coastal forest. The coastal forest is made up mainly of very large conifers. The striped area on the map shows where the boreal forest grows. The boreal forest is made up of many hardwood and conifer trees.

Place an x on the map to show the place where you live. Now answer the following questions by circling the correct answer.

1. Does the map show that you live in a forested area? yes no
2. If yes, which kind of forest occurs in your area? boreal forest coastal forest
3. If you do not live in a forested area, which kind of forest is nearest to your home?

   boreal forest coastal forest both kinds of forests are close to where I live

Alaska Wildlife Week Unit 5. Forests © 1987 ADF&G

14

Activity Ideas for Curriculum Integration

Lesson 1 **Primary**

LANGUAGE ARTS / SCIENCE **Outdoors**
Adopt a Tree **Groups / Individual**

OBJECTIVES: Students will practice observation and communication skills while becoming more aware of the trees in your area and more sensitive to changes in the natural world.
MATERIALS: Trees within easy walking distance of your classroom or students' homes. (If you live in a forested area but do not have trees near your school, you could make it a class project to plant one or two--possibly a conifer and a hardwood.)
PROCEDURE:

1. SELECT THE TREES TO ADOPT--Have students select one or two trees from your school yard or a nearby area for the class to "adopt." (You coud make the selection by first holding a contest, or by choosing the oldest, the biggest, the prettiest, most unusual, or other category of tree.) OR, have each student select their own tree. You may want to select one conifer and one hardwood and compare the two.

2. STUDENTS MAKE A BULLETIN BOARD OR JOURNAL: Have students make a bulletin board about the class tree that includes a calendar of the year, or remaining months of school. Or have them make individual journals about the class tree, or their own tree.

3. STUDENTS OBSERVE THEIR TREE: Ask students to visit their adopted tree each day (or week) at recess or before school. Have a special time each day to have students add to their tree bulletin board or journals. Ask for volunteers or select students each day to tell something new they noticed about the tree. Add these observations to the tree calendar or journal. Encourage them to look for buds, flowing sap, seeds, bare ground under the tree, insects or birds visiting the tree, changes in its color with different lighting conditions, etc. Suggest that they look at their adopted tree from different angles, up close and from a distance, draw pictures of it, write a poem about it, do bark or branch rubbings, or prints (see Art Activity--Tree Wrappings).

4. INTEGRATE THE TREE INTO LANGUAGE ARTS LESSONS: Have students write specific things in their tree journals--poems, complete sentences, adjectives that describe the tree; or encourage use of different senses--seeing, listening, smelling, tasting, feeling. (Use blindfolds or closed eyes to enhance non-visual observations.) Have students describe their observations in writing, or orally.

SOCIAL STUDIES / SCIENCE
Indoors **Group**
The Right Environments

OBJECTIVES: Students will become more aware of their environments and the effects of the environment on living things, particularly trees.
MATERIALS: paper and pencil, map of local area
PROCEDURE:

1. DISCUSS ENVIRONMENTS AND ADAPTATIONS: Discuss the students' environment--the classroom. Would they be comfortable if the heat were turned off? Way up? If the floor was flooded? If the air was very dry and they had no drinking fountain? Have them discuss what they could do in these situations to be more comfortable (put on a coat, wear shorts, wear hip boots, bring a thermos of water). Discuss what a tree, or other living thing, could do to be comfortable in an environment for which it was not adapted. Students should recognize that, unlike humans, other living things cannot live if their environment is changed. They can only survive in the environment(s) to which they are adapted.

2. DISCUSS WHY DIFFERENT KINDS OF TREES OCCUR IN DIFFERENT PARTS OF ALASKA AND THE WORLD. Have students relate their understanding of the fact that living things are adapted to live in certain environments to the fact that palm trees do not grow in Alaska, why the forests of Florida, or New York, look different from Alaskan forests, why the forests of coastal Alaska (Pacific coastal rain forest) are different from those of central Alaska (the boreal forest). Have them extend this tc an understanding of why trees do not grow in many parts of Alaska.

LANGUAGE ARTS / SOCIAL STUDIES / SCIENCE

Indoors/Outdoors

DO YOU LIVE IN A FOREST?

Groups

OBJECTIVES: Students will practice observation and communication skills and will learn the similarities and differences in the natural environment in different parts of Alaska.

MATERIALS: Paper, pencils; contact persons or classes in other parts of Alaska; Alaska map. Optional: Depending upon the way you choose to extend this activity, you may want access to a teleconferencing network, a video camera, tape recorder, and/or 35 mm camera to facilitate an exchange of information between schools.
PROCEDURE:
1. STUDENTS DISCUSS ALASKAN ENVIRONMENTS: Discuss the characteristics of the place students live--the climate (rain, snow, temperatures, amount of sunshine), whether or not trees grow in the area, which trees they are, whether they live in a forest, and what kind of forest they live in. Ask students whether other places have the same kind of environment as the place they live? Name places close and far away, identifying where these are on an Alaska map. After discussing this question, ask students how they could find out about these other areas? Try to get them to generate the idea of writing or calling people (specifically other students) who live there.

2. STUDENTS CONTACT A CLASS IN ANOTHER AREA: Have students put together information about their own surroundings. This might include drawings, photographs, written material, measurements, samples of tree branches and cones, tape recordings, videotapes, or other material. Next, have students develop questions to ask students who live elsewhere. Have the class write (or call) another class to share information about their respective environments. This exchange will be most informative for students who live in different forest types, or in forested versus non-forested areas. A whole school could combine efforts to get information from many areas and develop a display on environments of Alaska (tie pictures sent by others throughout the state to locations on an Alaska map). Or splice videotapes together to make an Alaska environments film.

ART

Indoors/Outdoors **Group/Individual**

TREE WRAPPINGS

OBJECTIVES: Students will become aware of the patterns of trees and use these to make artworks or gift wrapping.

MATERIALS: Sheets of newsprint, ink pads, charcoal, or crayons; branches, bark, leaves of trees.

PROCEDURE: 1. STUDENTS OBSERVE NATURAL PATTERNS: Take students outdoors where they'll have easy access to a variety of trees. (Alternatively. they may bring in samples of leaves, tree branches, and bark.) Explain to students that a pattern is any repeated design--such as the pattern of branches on a spruce tree, or the scars in birch bark. Help students find different ways of looking at trees or tree parts (from far away, close up, by lying down and looking straight up). Have students look for patterns from each of these perspectives.

2. STUDENTS USE NATURAL ITEMS TO MAKE THEIR OWN PATTERNS: Students can change newsprint into gift wrap or an artwork by transferring some of nature's patterns onto the paper using any of the following techniques:

a. Place newsprint over bark, a branch or leaf and then rub over it with charcoal or crayons.
b. Press a branch, leaf, or cone onto an ink pad, then press it on to the paper.
c. Paint the item with ink, then gently press paper on to it.
Students can create their own patterns by repeating natures patterns all over their paper.

Lesson 2.

Vocabulary

animal, ecosystem, fungi, hyphae, living things, microscopic organism, non-living things, plant

Objectives:

Students will recognize the non-living parts and the kinds of living things found in forests, and will recognize that these vary between forests, and locations.

Background:

Trees are an important part of forests, but forests are more than just trees. A forest is an ecosystem made up of non-living parts and a wide variety of living thing. The non-living environment and living things affect each other.

NON-LIVING THINGS: Air, water, soil, and energy in various forms, most importantly as sunlight, make up the non-living environment. The non-living environment varies from one place to another. The air may be warm or cold, moist or dry. The soil may hold a lot of water or little. A particular spot (on a southfacing slope) may get a lot of sunshine, while another (on a north facing slope) may get less.

LIVING THINGS: A variety of living things occur in forests, including plants, fungi, animals, and microscopic organisms.

PLANTS are among the easiest living things to notice because they don't move around. If you look up, you see the largest plants, the trees. If you look straight ahead or down slightly, you'll see the shrubs or bushes (called the understory). If you look down, you'll see groundcover plants, such as herbs, grasses, mosses, and ferns. Most plants are green, and make stored energy from sunlight, carbon dioxide and water. They combine the stored energy with minerals from the soil in order to grow.

FUNGI, such as mushrooms, toadstools, shelf fungi, molds, rusts, mildews, and rots are easy to find because their above-ground parts do not move around. But fungi are very different from plants. Usually we see only the fruiting part of a fungi (the reproductive part); the main body of fungi are microscopic hair-like structures, called HYPHAE. The hyphae of fungi grow through the ground, wood, or other material. A handful of forest soil may contain over 2 miles of fungal hyphae. The hyphae act like an inside-out stomach of an animal--they give off juices (called enzymes) that break down the fungi's food. The hyphae get the stored digested materials by absorbing the pre-digested food. Most fungi feed on dead plants and animals.

The ANIMALS found in forests include birds, mammals, amphibians, insects, and other invertebrates (animals without backbones) like spiders, centipedes, and worms. In addition, many fish live in forest streams. Although many forest animals hide from people, it is easy to find their signs, such as tracks, droppings, nests or dens, and leaves or stems of plants that are chewed. Many small animals live in the forest soil; each time you step on the forest floor you are stepping on literally thousands of insects and other invertebrates. Some of the most important soil animals are springtails, beetles, mites, worms, centipedes, and spiders. (Typical earthworms do not occur in most of Alaska, but there are many kinds of small segmented worms that occur in the soil here.) All animals get stored energy and minerals (or food) by eating other living (or dead) things.

The living things that are easiest to overlook in a forest are the MICROSCOPIC ORGANISMS, those too small to be seen without a microscope. Scientists used to consider these living things to be small versions of plants and animals. Today, however, most scientists consider them to be so different, that they have placed them in two separate groups, the monerans and protists. (These two groups are not easily distinquished; monerans are much smaller and do not have cell nuclei. The moneran group includes bacteria and blue-green algae. The protist group includes amoeba, paramecium, and other algae.) Microscopic organisms are living just about everywhere in a forest, but the greatest number are in the soil. A single tablespoon of forest soil may contain 3-10 billion of these tiny living things. Some microscopic organisms, like algae, can do photosynthesis and make their own food, but others (like bacteria) get food by eating other organisms.

VARIATION BETWEEN FORESTS: All forests include the same non-living and living parts (plants, animals, fungi, and microscopic organisms.) However, different sites and forests have non-living environments with different characteristics (dry or wet, cold or warm, little light, or much), and provide habitat for different living things. Every species of living thing has specific habitat requirements, and specific tolerances for heat and cold, light, moisture, and other characteristics of the non-living environment.

Since the characteristics of the non-living environment vary between areas, the kinds of living things present also varies. Some species (such as brown bears) have general habitat requirements, and wide ranges of tolerance for environmental conditions and thus occur in many different environments. But species with narrow ranges of tolerance for environmental conditions, or with very specific habitat requirements occur only in specific environments. Thus, some kinds of living things occur only in forests, and some, only in a specific kind of forest.

The Primary Forest Wildlife Cards on the following pages provide drawings and information about some of the more common forest wildlife. Two pages in the set show wildlife common to only one forest type; you should use only one of these two pages--whichever one illustrates wildlife that occur in the forest of your area. For additional information on these wildlife and a wide variety of other species, please check the library copy of the Forest Wildlife Cards for upper elementary and junior/senior high school students. Those may be adapted for use with primary if you desire.

Introductory Activity 2

Objectives:

Students will practice communication skills and become familiar with the parts of the non-living environment and the variety of living things found in Alaskan forests.

Materials:

Forest Wildlife Cards for primary students (see following pages), colored pencils, bulletin board, light blue construction paper, construction paper cut-outs of clouds, rain, and the sun; soil, sand, or brown paper; a long, shallow box to fit on a table beneath the bulletin board; green construction paper, green balloons, popscicle sticks, toothpicks, clay or playdough, tape (See steps 3 and 4 for details on use of these materials. You may be able to substitute other materials.) (Optional: posters of living and non-living things from the 1986 AWW packet, if available).

Procedure:

1. STUDENTS TRY TO GUESS WHAT THE CARD ON THEIR BACK REPRESENTS: Pin one of the primary Forest Wildlife Cards to the back of each student. Explain that students will have 10 minutes to try to figure out what the card on their back shows. Explain that all the cards show something that is found in an Alaskan forest. Sns can find out what their card represents by asking other students for clues. They get clues by asking questions: Is it alive? Is it a plant? What color is it? and so on. Other students may look at and read the information on the cards of others in order to answer the questions. Stress that if a student does not know the answer to another student's question, and can't find the answer on the card, he/she should just say, "I don't know." Encourage students to help each other figure out their card. At the end of 10 minutes, have each student tell tell what he/she thinks his/her card represents. If the student is correct, repin the card to the front of their shirt. If a student is incorrect, give them some additional clues to help them guess, then repin their card.

2. STUDENTS CLASSIFY THEIR CARDS: Explain that all these cards represent things that are found in forests. Forests are ecosystems made up of non-living and living things. (Place the 1986 posters of these on the board if you have access to them.) Discuss the differences between these groups and ask those students who represent non-living things to raise their hands. Everyone else represents a living thing. Explain that scientists classify living things according to their similarities and have divided living things into five "great groups," or kingdoms: plants, animals, fungi, monerans and protists. (Explain that the last two groups include mainly microscopic organisms and the two groups are very hard to tell apart without a powerful microscope.) Each card indicates the "great group" or kingdom to which the pictured living thing belongs. Have students classify themselves according to these great group categories. Discuss the kinds of living things placed in each category.

3. STUDENTS MAKE A FOREST MODEL: Have students make a 3-dimensional model of a forest. They first need the parts of the non-living environment: air, water, sunlight, and soil. Place a large flat box with an open top on a table beneath a bulletin board. Cover the bulletin board with light blue paper (to show air), place a cut-out of the sun in one corner, along with cut-outs of clouds and raindrops. Fill the box with soil (or cover it with brown paper to represent soil).

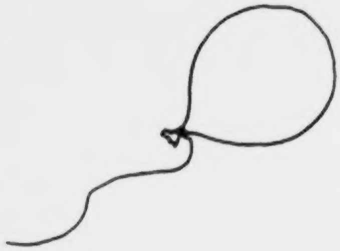
Have each student make a tree, and 1 other living thing that occurs in the Alaska forest they are modeling. They can make conifer trees by cutting out half circles of green construction paper, then rolling these and pasting the straight edges together to form a cone. They can then place this cone over a popscicle stick to form a tree. Hardwood trees can be modeled by blowing up small green balloons and attaching these with tape to popscicle sticks. Students plant their trees by placing them in the soil. (You might mention that a better model of a tree would also have roots; these models have imaginary roots.)

4. STUDENTS MAKE MODELS OF OTHER LIVING THINGS FOUND IN FORESTS: Have students make small scale models of the various animals, fungi, and other kinds of plants found in forests. The shrubs can be modeled using smaller balloons, or toothpicks with bits of green construction paper glued on. Students can build clay or playdough models of the animals shown on the cards, or just color in photocopies of the cards, then cut out the drawing and tape these onto trees, or onto toothpicks which can be stuck into the "soil."

5. STUDENTS COMPLETE WORKSHEETS 2a and 2b. These drawings of the two types of forest in Alaska are intended to increase student awareness of the variety of living things found in forests, and to enhance their awareness of the two different types of forests in Alaska.

Primary Forest Wildlife Cards

Air



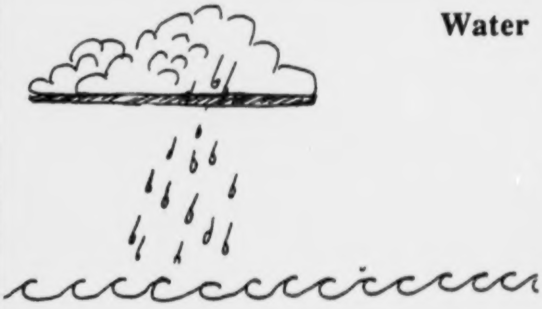
Air is all around us, but we rarely notice it. All living things need it.

Plants get the carbon dioxide they need to make food from the air.

Animals get the oxygen they need to breathe from the air.

Non-living

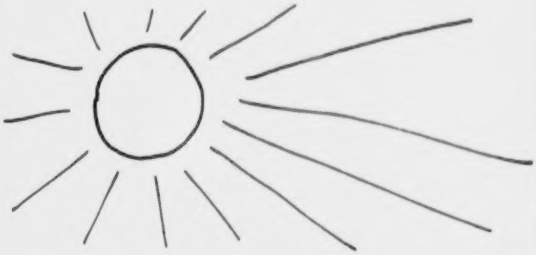
Water



Water occurs all around us. It is in the air in the form of clouds, rain, and snow. It forms streams, lakes, and the ocean. Water is also in the ground.

Non-living

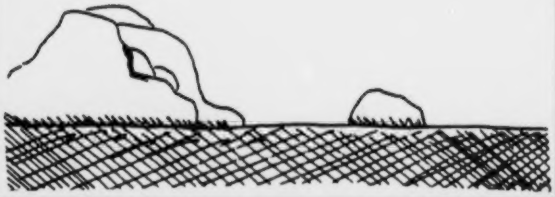
Sunlight



Energy is the force that makes things move and warms things up. The most important kind of energy is in sunlight. Plants catch the energy in sunlight to make food.

Non-living

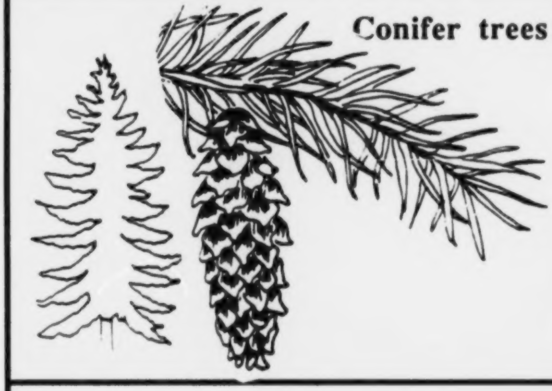
Soil and Rocks



Soil and rocks are found everywhere on earth. Soil contains the minerals that plants need to make food.

Non-living

Conifer trees

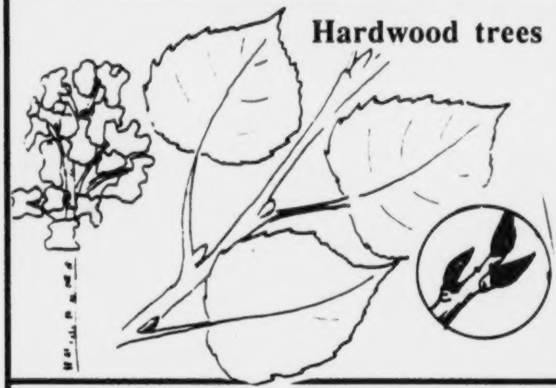


Conifer trees make food from air, water, sunlight, and minerals from the soil.

They need help from another living thing in order to get minerals from the soil.

Plant

Hardwood trees

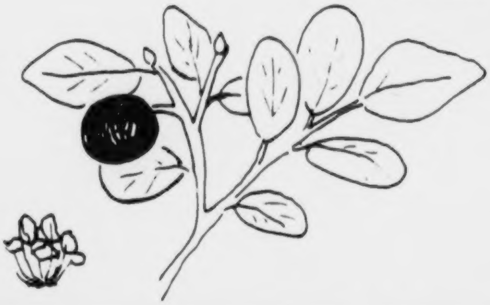


Hardwood trees make food from air, water, sunlight, and minerals from the soil.

They need help from another living thing in order to get minerals from the soil.

Plant

Shrubs



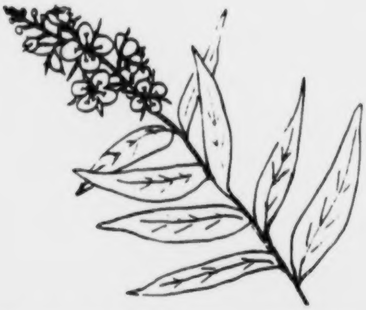
These shrubs make food from air, water, sunlight, and minerals from the soil.

Shrubs make seeds and berries.

They need help from another living thing in order to get minerals from the soil.

Plant

Herbs



Herbs make food from air, water, sunlight, and minerals from the soil.

Herbs make seeds and berries.

The flowers of some herbs need an insect to carry their pollen to other flowers.

Plant

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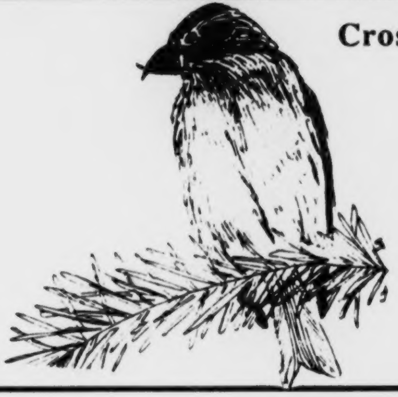
Crossbills

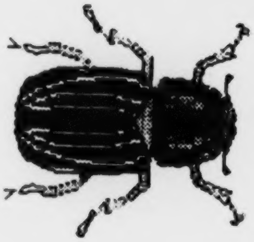


Crossbills have specially shaped bills that cross at the tips. This bill helps them get their food--the seeds out of the cones of conifer trees.

They nest in conifer trees. Male crossbills are red. Female crossbills are yellow or brown.

Animal

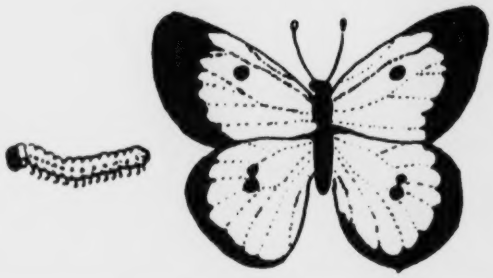
Bark Beetles



Bark beetles live beneath the bark of conifer trees and eat the wood in the trunk.

Animal

Caterpillars and Butterflies



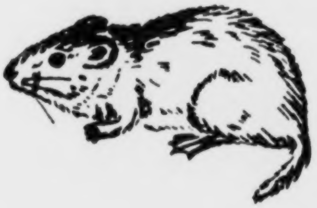
Caterpillars eat the leaves of hardwoods, shrubs, and herbs.

Caterpillars grow up and turn into adult butterflies. Butterflies eat nectar from the flowers of herbs.

Butterflies carry pollen from one flower to another.

Animal

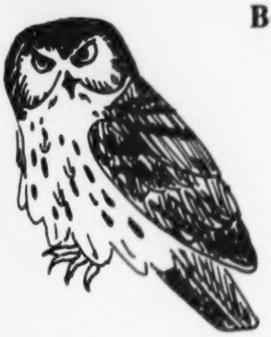
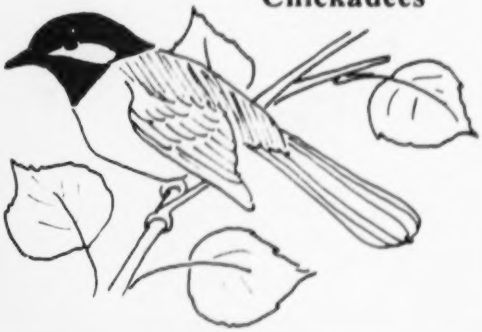
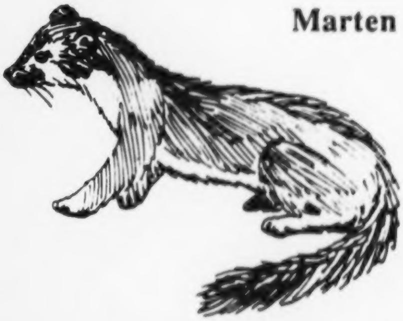
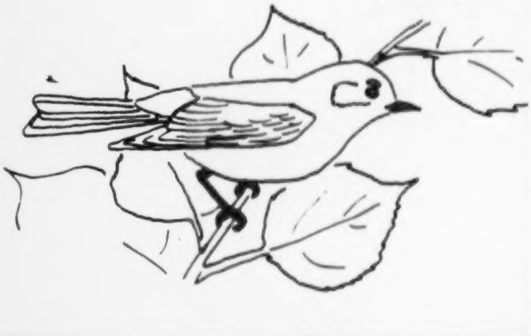
Voles

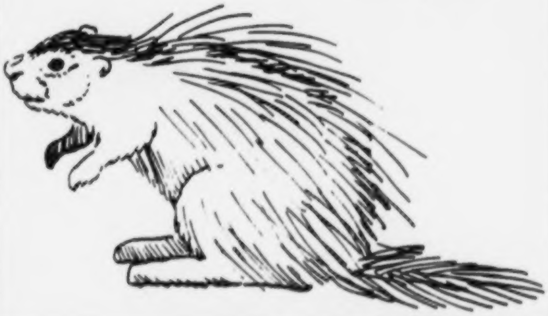
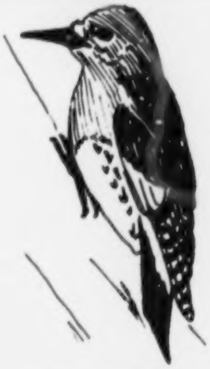
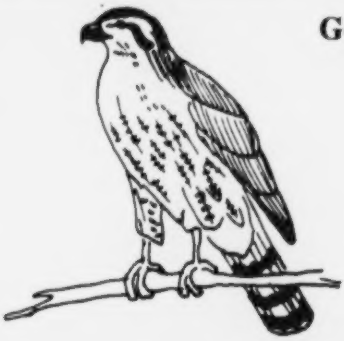
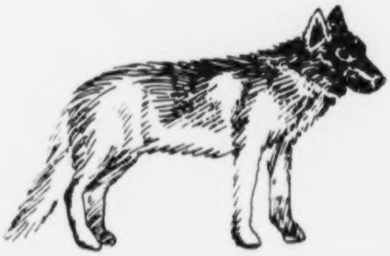


Voles eat the seeds and berries of herbs. They also eat mushrooms.

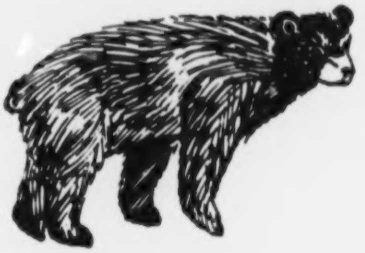
These small mammals look like mice, but they have short tails.

Animal

Boreal Owls 	These small owls feed on voles, mice, and small birds like warblers, chickadees, grosbeaks, and crossbills. Owls have special eyes that let them see well even in the dark. They are also able to hear very well. These owls need holes in trees for nesting, but they cannot dig their own holes. **Animal**
Chickadees 	Chickadees eat insects that live on the leaves of trees, shrubs, and herbs. They need small holes in the trunks of dead trees in order to nest. But chickadees cannot dig holes in tree trunks. **Animal**
Marten 	Marten eat mainly voles and mice. They sometimes eat squirrels, hares, or porcupines. Marten use hollows in large trees for den sites. **Animal**
Warblers 	Most warblers have some bright yellow feathers. They feed on insects, like caterpillars, that live on the leaves of trees, shrubs, and herbs. Most warblers build their nests in shrubs. **Animal**

Porcupines 	Porcupines eat the inner layer of bark from conifer trees and many kinds of herbs and shrubs. A porcupine has over 10,000 quills on its body. These protect it from most predators. **Animal**
Woodpeckers 	Woodpeckers eat insects, like bark beetles, that live under the bark of conifer or hardwood trees. Woodpeckers dig holes in tree trunks. Many other animals use the old holes of woodpeckers. **Animal**
Goshawk 	Goshawks are a kind of large hawk that live in forests. They feed on grouse, voles, mice, and on red and flying squirrels. They usually build their nests in large hardwood trees. **Animal**
Wolf 	Wolves feed mainly on moose and deer. They sometimes eat voles, mice, beavers, or other animals. **Animal**

Black Bears

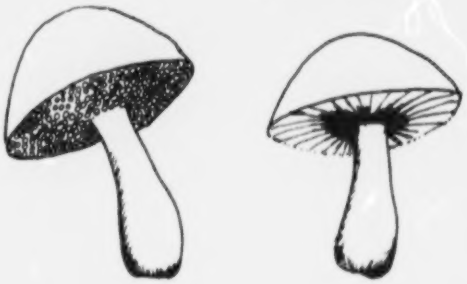


Black bears eat herbs, berries of herbs and shrubs, fish, and sometimes the calves of moose or deer.

Many black bears use trees that are hollow in the center as places to spend the winter.

Animal

Mushrooms

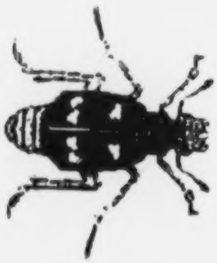


Mushrooms are a type of fungi. Most mushrooms feed on dead and decaying leaves and the wastes of animals.

They can help many plants get minerals from the soil.

Fungi

Carrion Beetles

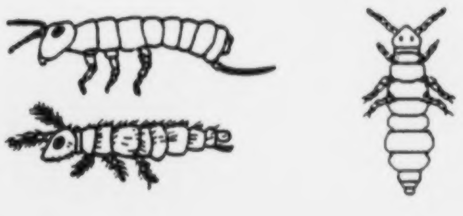


Carrion beetles eat dead animals and waste materials. They bury the dead animals they find in the soil and lay their eggs on them. Most carrion beetles are black with red or yellow spots on their backs.

These beetles can give other tiny insects a ride to new places in the forest soil.

Animal

Springtails



Springtails are small insects that live in the soil. They have a special tail-like part that lets them spring into the air. Many hundreds of them live in every handful of forest soil. They eat dead plant leaves and waste materials of animals.

Animal

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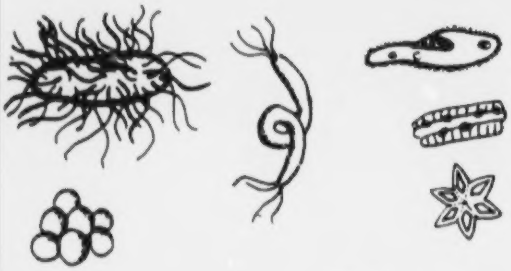
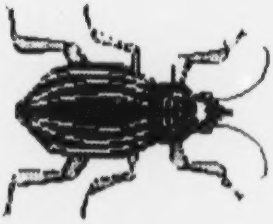
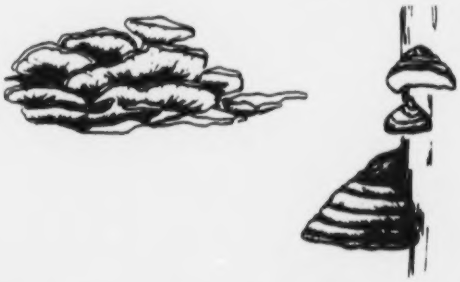
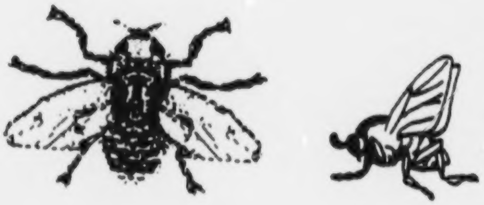
Microscopic living things 	Millions of microscopic living things live in every handful of forest soil. Many of these feed on dead plants and animals. **Protists and Monerans**
Ground beetles 	These black beetles live on the forest floor. They feed on other insects. **Animal**
Shelf fungi 	Shelf fungi are a special type of fungi. Most of them live on dead or live trees and feed on the wood in the trunk. These fungi decay wood and help form hollows and holes in trees. **Fungi**
Blow Flies 	These flies are a kind of insect. They feed mainly on dead and decaying animals and animal wastes. Sometimes, these flies carry pollen from one flower to another. **Animal**

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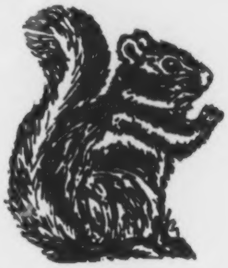
Red Squirrels

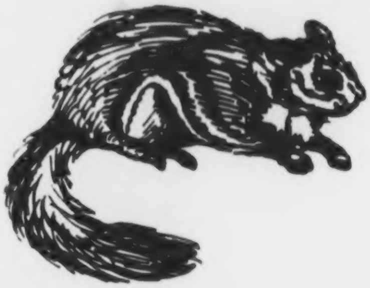


Red squirrels eat mainly the seeds of conifer trees. They also eat mushrooms and the eggs of small birds.

They help scatter the seeds of conifers and the spores of mushrooms.

Animal

Northern Flying Squirrels



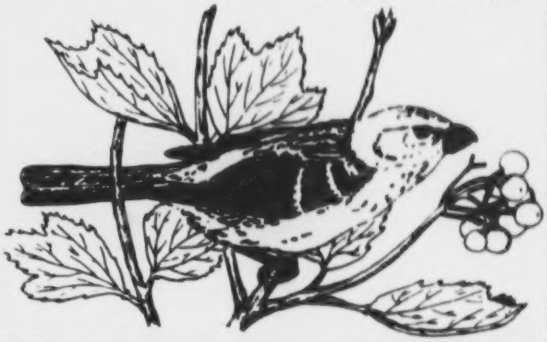
Flying squirrels eat mainly mushrooms and other fungi, but they also eat the seeds of conifers and certain herbs.

They scatter the spores of mushrooms and other fungi.

They need a hole in a tree trunk, but they can not dig holes for themselves.

Animal

Pine Grosbeaks



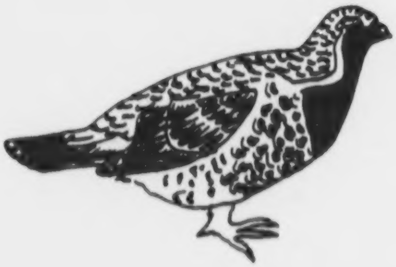
Pine grosbeaks eat the buds of hardwood trees, the seeds of conifers, and the berries of certain herbs.

They help scatter the seeds of certain herbs through the forest.

Male pine grosbeaks are red. Female grosbeaks are golden yellow.

Animal

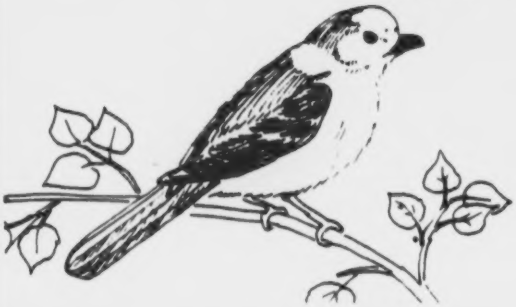
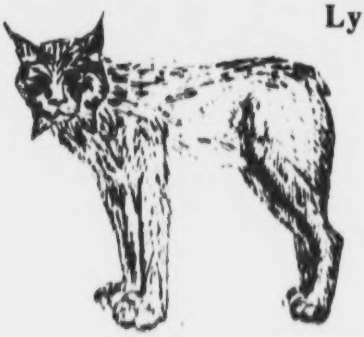
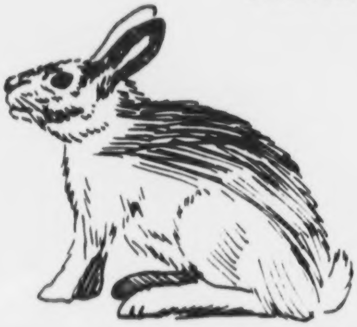
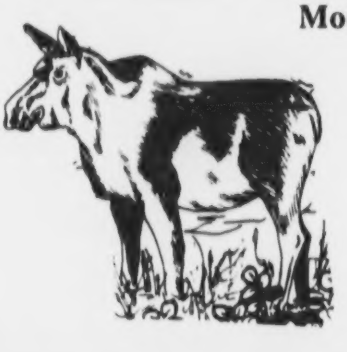
Grouse



Grouse eat berries from herbs and shrubs, and the buds and seeds of conifers, hardwoods, and shrubs.

Animal

Animals that live mainly in boreal forests

Gray Jay 	Gray jays are the same color as their name explains. They feed on berries and seeds, on eggs of birds, on voles, and on dead animals. They build their nests in conifer trees. **Animal**
Lynx 	Lynx feed on snowshoe hares. They also eat voles and grouse. They make their dens under the branches of conifer trees. Lynx are able to hear and see very well. They have large feet to help them walk on top of the winter snow. They are able to run quickly and jump several feet. **Animal**
Snowshoe Hare 	Snowshoe hares feed on the leaves and branches of shrubs and young hardwood trees. Hares hide from predators in places where many shrubs grow together. They grow white fur to match the winter snow, and brown fur to match the ground in summer. They are called "snowshoe" hares because their large hind feet work like snowshoes. They help the hare walk on top of deep winter snow. **Animal**
Moose 	These large animals feed on the leaves and branches of shrubs and young hardwood trees. **Animal**

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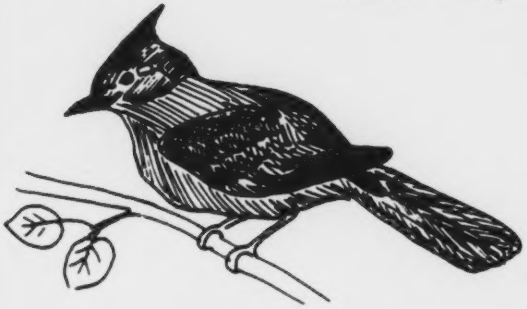
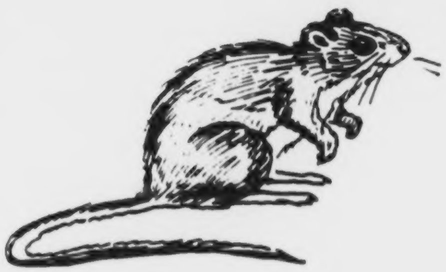
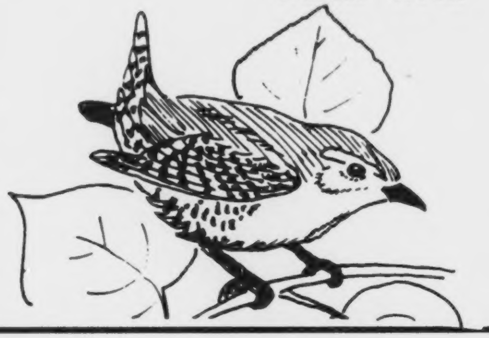
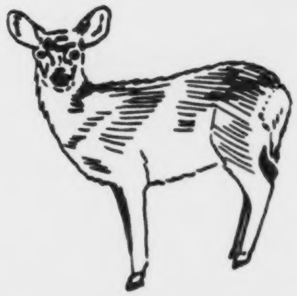
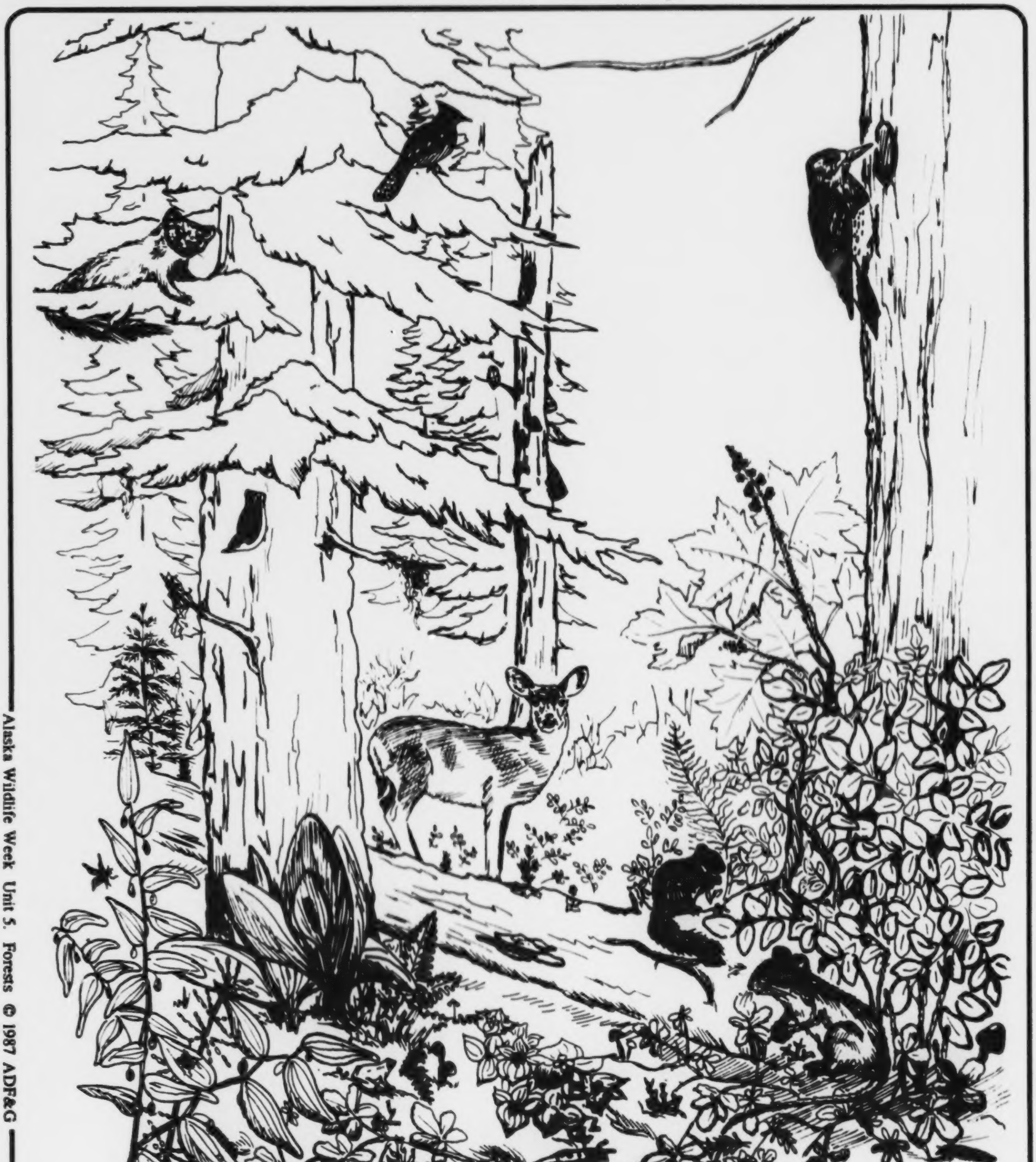
Animals that live mainly in coastal forests

Steller's Jay 	Steller's jays are bright blue and black birds. They feed on berries, insects, voles and mice, bird eggs, and on dead animals. They build nests in conifer trees. **Animal**
Deer Mouse 	These mice got their name because they have large brown eyes that look like the eyes of deer. They feed on insects that live in the soil and on berries and seeds of shrubs and herbs. They hide under logs and herbs. **Animal**
Winter Wren 	Winter wrens are one of the smallest birds in Alaska. Their feathers are brown, black, and white. Winter wrens feed on many kinds of insects. They live near the forest floor, among shrubs and herbs. **Animal**
Sitka black-tailed deer 	These small deer live in coastal forest. They feed on the leaves and branches of herbs, shrubs, and certain hardwoods and conifers. **Animal**

Coastal Forest Worksheet 2a

Name ______________________________ Primary

As you color this drawing of the coastal forest, count the number of different kinds of plants, fungi, birds, mammals, insects, and other invertebrates. Can you find 14 different kinds of animals? 8 kinds of plants? 2 kinds of fungi?



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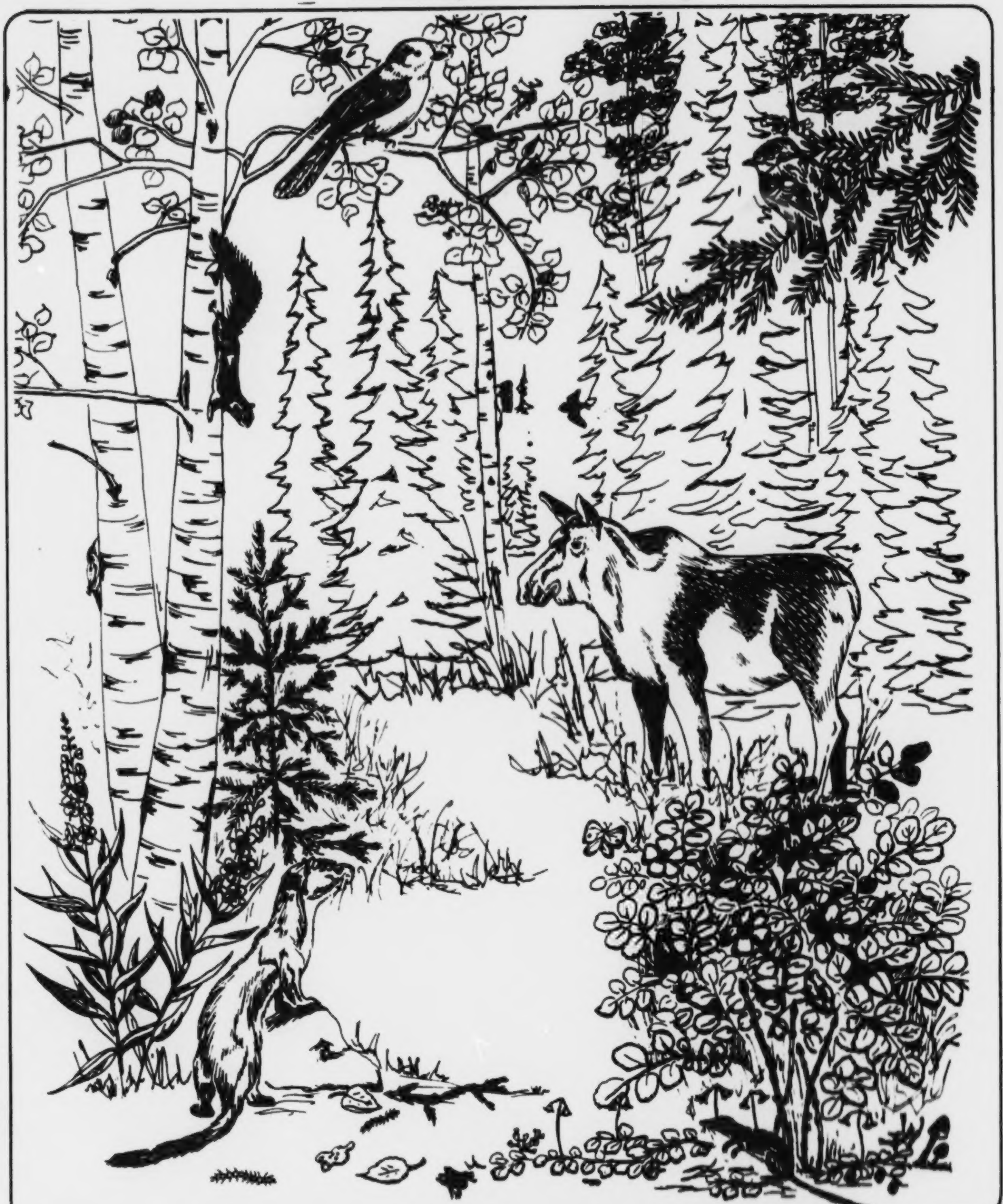
Boreal Forest Worksheet 2b

Name ____________________

As you color in this drawing of the boreal forest, count the number of animals (birds, mammals, amphibians, insects and other invertebrates) and the number of kinds of plants and fungi that you find. Can you find 12 kinds of animals? 7 kinds of plants? 3 kinds of fungi?



Alaska Wildlife Week Unit 5. Forests © 1987 ADF&G

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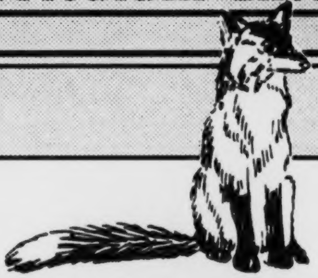

SCIENCE / LANGUAGE ARTS

Active / Indoors / Outdoor **Groups**

Dive for the Forest Creature

OBJECTIVES: Students will practice reading, speaking, and listening skills while becoming more familiar with non-living and living things founds in forest ecosystems.
MATERIALS: A set of primary Forest Wildlife Cards (from this packet), picture and text sides separate, several 8 foot lengths of rope, or a method of drawing movable lines on the floor or ground.
PROCEDURE:

1. BEFORE CLASS: Divide the Forest Wildlife Cards (living things only) into piles of 10--include matching text and picture cards in the same piles.
2. DIVIDE THE CLASS INTO TEAMS: Divide the class into an even number of teams of up to 7 players each. Appoint a team captain for each team (this position will rotate). Have pairs of teams line up facing each other, then take two steps back. Lie the ropes down in front of each team, or draw lines on the floor or ground. Each team must stay behind their line. Team members on both sides count off so each has a number between 1 and 6. Team Captains stand at opposite ends of the lines, but between the lines.
3. TEAM CAPTAINS SELECT AND PLACE CARDS: The two Team Captains from each pair of teams should then pick up a pile of Forest Wildlife Cards. They should put the picture cards down, face up, (so that all cards are visible) between the two teams, then divide the text cards between themselves.
4. PLAY THE DIVE FOR THE FOREST GAME: The object of the game is for each team to pick up as many of the picture cards as they can. The team with the most cards (once all cards are picked up) wins the round.

RULES:

a. One Team Captain will first call out a number to indicate the team members who are to dive for a card; the other Team Captain will give clues about the card to be picked up. Each time a correct card is picked up, Team Captains will alternate duties.

b. Team Captains will use the information on the text portion of the card to make up clues to the picture portion of the card. They will give the following clues in order: A clue about what the organism eats (or if it makes food from air, water, soil, and sunlight), one clue describing it, and one clue naming it. For example, if the card to be picked up is a card of a flying squirrel, the Team Captain will read the text card and use the information to make up clues, such as the following:
What it eats: This living thing eats fungi, seeds, berries, and insects.
Description: This living thing flies between trees.
Name: It is a flying squirrel.

c. Only the team members whose numbers were called may try to pick up the correct card. These players may do so any time after the first clue.

d. If a player picks up a correct card, their team retains it. If a player picks up an incorrect card, the Captain reading clues states that it is wrong. That team's line is then moved back one step, the card returned to the center, and additional clues to the correct card are given until it is picked up.

e. When all 10 cards have been picked up, the team with the most cards wins the round. The number one players then become the new Team Captains, and the former Team Captains become the new number six players. Be sure to renumber all players (2 becomes 1, 3 becomes 2, etc.). The new Team Captains return the used set of cards and pick up a new set of 10. Repeat the game for as long as desirable. This game could be played for 15 minutes each day using different cards each day.

CREDIT: (This activity modified from the activity described on page 71, in "Sharing Nature With Children" by Joseph Cornell.)

Activity Ideas for Curriculum Integration

Lesson 2 **Primary**

SCIENCE Indoors / Potentially Noisy
Forest Wildlife Match! Pairs or Groups

OBJECTIVES: Students will practice classifying living things.
MATERIALS: Forest Wildlife Cards (text and pictures together)
PROCEDURE:
1. SELECT CATEGORIES AND REVIEW: Choose the kind of classification with which students need practice (for example: recognizing the five kingdoms; or classifying animals as vertebrates, invertebrates, birds, insects, mammals, etc.). List the selected category (or categories) in large letters on a piece of paper and discuss if necessary. Choose just one match category for students to look for.
2. PASS OUT CARDS AND PLAY "WILDLIFE MATCH!" Divide the Forest Wildlife Cards so each student has a pile. The object of this game is to take the most number of matched cards.
RULES:
a. On each turn, a player turns one card from his/her pile face up onto a discard pile. Play rotates right.
b. When any player sees a dealt card that belongs to the same category as another face-up card, he/she slaps a hand down and says "Wildlife Match!" (or other appropriate category) and specifies which cards match. If the match is correct, the player takes the matched card(s) (from other player(s) and/or their own pile), and saves these in a separate "Matched Pairs" stack.
c. If a player slaps his/her hand down and incorrectly calls a match, he/she loses a turn.
d. When all cards have been played from any player's hand, all discards and cards remaining in other players' piles (not from Matched Pairs stacks) are reshuffled together; this new deck is then shuffled and redealt .
e. Game ends when no more matches are found or at the end of a specified time.

ART / SCIENCE Quiet / Indoors
Forest Creature Close-ups Group

OBJECTIVES: Students will practice reading and writing skills and increase their knowledge of forest wildlife.
MATERIALS: References on wildlife; paper, pencil.
PROCEDURE: Have students write a "Forest Creature Close-Up" about a living thing that occurs in an Alaskan forest. Their report should include a drawing of the living thing, tell one interesting fact about the organism, and describe how the organism lives. Use the primary Forest Wildlife Cards (or library copy of the version for older students) as a guide to help students select wildlife for their reports. Students may be able to get information, about the living thing they select, from books on forests or animals, encyclopedias, films about wildlife, or TV nature programs. If desired, students could type their reports up on a computer and "send" them to an "editor" for possible publication. You or a parent could edit, have the "author" make corrections, then combine student works to make a Creature Close-Up file or a booklet for other students to read.

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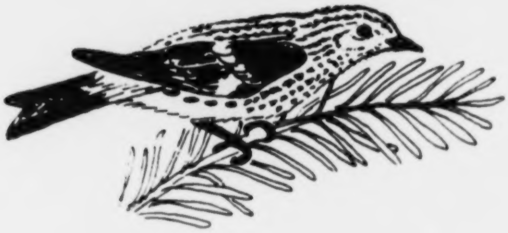
Lesson 3.

Vocabulary

carnivore, consumer, detritivore, energy, food, food chain, food web, herbivore, interdependent, producer, minerals, symbioses



Objectives:

Students will recognize that living things in forests need each other (are interdependent).

Background:

Like all ecosystems, forest ecosystems are held together by many interconnections among living things and the non-living environment, including food chains and webs, and symbioses.

FOOD CHAINS AND WEBS: All living things must have energy and minerals in order to move around, grow, and reproduce. Energy exists in the non-living environment as sunlight as well as in other forms. Minerals exist in the air, dissolved in water, and in the soil. The pathway of energy and minerals from the non-living environment through living things and back, is called a FOOD CHAIN.

Food chains begin with PRODUCERS, living things that can use energy and minerals directly from the non-living environment. The most important producers in forests are trees and other plants, although some microscopic organisms, such as algae, are also producers. These organisms capture the energy in sunlight through the process of photosynthesis [the combining of sunlight (energy) with water, and carbon dioxide from the air, to make carbohydrates such as sugar (or stored energy).] They combine this stored energy with minerals to form their body parts. Plants absorb the minerals they need from the soil through their roots. Algae absorb minerals dissolved in water. Plant leaves, flowers, seeds, stems, and roots, as well as algae cells thus contain stored energy and minerals--or FOOD for other living things.

Other living things can not survive on sunlight, water, air, and soil. Instead, they must eat, or consume, food (stored energy and minerals), and are called CONSUMERS. There are many kinds of consumers; an organism is classified according to the kind of food it eats most often.

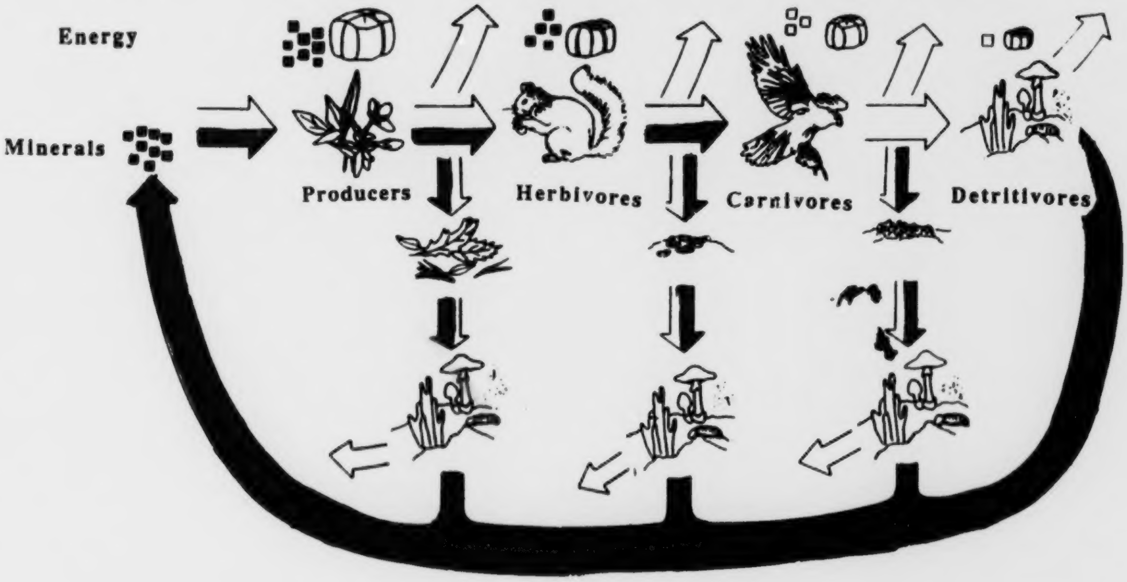
Consumers that get food by eating mainly producers (plants or algae) are called HERBIVORES (which literally means plant-eater). They form the next link in food chains. Deer, hares, squirrels, porcupines, grouse, juncos, caterpillars, and aphids are examples of forest herbivores.

Those that get food by eating other consumers are called CARNIVORES, and form the next link in some food chains. Wolves, lynx, shrews, weasels, woodpeckers, chickadees and other insect-eating birds, spiders, centipedes, and some beetles are all forest carnivores.

Some consumers get food by eating dead organisms or waste materials such as fallen leaves, animal droppings, or dead animals. These consumers are called DETRITIVORES. Many fungi, springtails, mites, and bacteria are detritivores; some large animals like ravens are also detritivores.

Some consumers usually eat a wide variety of things, including producers, other consumers, and dead or waste materials. These consumers are called OMNIVORES.

FOOD CHAINS: The pathway of energy and minerals through an ecosystem.

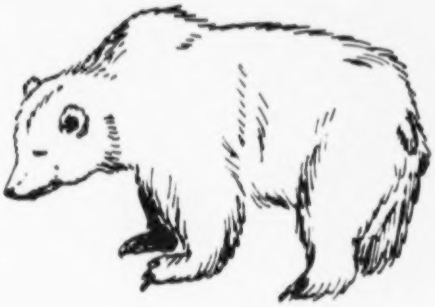


Food chains simply illustrate the pathway of energy and minerals from producers, through consumers (herbivores--carnivores--detritivores) and back to the non-living environment. Food chains may be short, or long. At each link in the chain, each organism stores some of the energy and minerals, loses some in wastes, and uses some energy to move, grow, and live. The used energy can not be reused. But the energy stored in the consumer, or in its wastes can still be used by the next link in the food chain. When some detritivore uses the last bit of stored energy in the wastes or a dead animal, only raw minerals are left. These minerals can be reused by a producer to make new food, and a new food chain begins.

There are many different food chains in a forest. In addition, almost every organism eats more than one kind of food, so each is part of several different food chains. All the food chains together form a FOOD WEB. All the living things in a forest are connected through the food web, and thus depend upon one another. (Deer need plants to eat, and wolves need deer to eat so both deer and wolves need plants. Since plants need minerals, they need detritivores to break down wastes and make the minerals available for reuse. Thus, deer, wolves, plants, and detritivores are interdependent--they all need each other.)

SYMBIOSES: Most living things also depend on organisms they are not connected to through food chains; these interconnections are called symbioses. For example, chickadees, boreal owls, and flying squirrels all need holes in trees, but they can't dig their own holes. Instead, they move into holes dug out by woodpeckers (after the woodpeckers are done with the hole). Many plants can not get minerals from the soil without the help of certain fungi. These fungi, called mycorrhizal fungi, actually live around or inside of the plant roots. The plant feeds them sugars, and they help the plant roots get minerals from the soil. Some mites ride on the backs of beetles to get a ride to new places to feed. Pollination is another example of symbioses. (There are three general kinds of symbioses: mutualism, commensalism, and parasitism. In each case, at least one of the involved organisms needs the other in order to survive. In mutualism, both species need and help each other; in commensalism, one species benefits and the other is unafffected; and in parasitism, one species (the parasite) benefits, and the other (the host) is harmed.

Introductory Activity 3



Objectives:

Students will practice communication skills and become familiar with the variety of ways in which the living things in forests are interdependent.

Materials:

Forest Wildlife Cards from this packet; Separate signs with the words "producers, consumers, herbivores, carnivores, and detritivores; paperclip, pen, (if desired, various lengths of yarn 6 in -3 ft); Alaska Wildlife Week Filmstrip, Part 2, Dukane projector, or filmstrip projector and tape recorder

Procedure:

1. STUDENTS CLASSIFY LIVING THINGS AS PRODUCERS OR CONSUMERS: Explain that all living things need energy and minerals to live and grow. Some living things get these from the non-living environment; they are called producers. Other living things get energy and minerals by eating foods; they are called consumers. Discuss which category humans belong to. Pass out one forest wildlife card to each student. Then, place the signs with the words producers and consumers at opposite ends of the room or blackboard. Ask each student to move to the sign under which the living thing on his/her card belongs. (Ask those students with cards of non-living things to check the classifications of other students to make sure they made the right choices.)

Encourage students to notice the kinds of living things that are producers (mainly plants) and the kinds of living things that are consumers (animals, fungi, and microscopic organisms.) Consumers are further divided into herbivores, carnivores, omnivores, and detritivores. Discuss these terms and place the respective signs up near the Consumer category sign. Have the students representing consumers divide themselves into these smaller categories. Review briefly the kinds of organisms found in each consumer category.

2. BUILD A FOOD CHAIN: Write the words air, water, soil, and sunlight on the board and draw a circle around them. Reiterate that these make up the non-living environment. Explain that living things that get energy and minerals from the non-living environment are called producers because they change these non-living things into a form that other living things can use. Select a student who is holding a plant card. Ask the student how the plant he/she represents gets the energy and minerals it needs. Have this student touch the circle around the non-living environment

Then, ask if any other student is holding a card of a living thing that eats this plant. Have one of these students come up and join hands with the plant. Then ask for a student holding the card of a carnivore that eats this herbivore. Ask this student to hold hands with the herbivore. Finally, ask for a student who has a card representing a detritivore that eats dead things or wastes, and have she or he hold hands with the carnivore player.

Explain that this chain of living things is called a "food chain"; it represents the movement of energy and minerals from the non-living environment, through living things, and ultimately back to the non-living environment. Describe the importance of the detritivore in returning minerals to the non-living environment where they can be used again by producers. Have the detritivore pull the "chain" into a circle by moving around to touch the circle of non-living things shown on the board. Remove the producer from the chain--can students predict what will happen to the other living things in the chain? (They will starve.)

Explain that there are many food chains in a forest, and the class is going to play a game so they can see how these chains interconnect.

3. STUDENTS FORM A FOOD WEB: Have students circulate around the room, and introduce themselves to each other as though they were the items on their cards. Instruct each student to give the name of the item he/she represents, the kind of thing he/she is (non-living, producer, or type of consumer), and what he/she eats or uses to survive:

"I am the minerals in rocks and soil. I am non-living. I do not eat."

" I am a spruce tree. I am a producer. I make my own food using sunshine, water, minerals, and air.

"I am a moose. I am a herbivore that eats the twigs of birch, willow, and other plants."

Whenever a student meets something it eats, eats it, uses (in the case of producers) or is used by (non-living things), those students should join hands or touch in some way (or have them join together with pieces of yarn if students do not want to hold hands). Any students who connect, or join, then remain together as a group. Other students introduce themselves to the groups that form. Several separate groups will form at first; these groups should then introduce themselves to each other. Eventually, the whole class should become interconnected. Congratulate the class on becoming a forest food web (or at least a model of one)! Explain that a food web is all the food chains of an ecosystem together.

4. REMOVE AN ORGANISM FROM THE FOOD WEB: Ask what would happen to the ecosystem if one of the organisms in the food web were removed. Tug on, or squeeze the hand of one player as if to remove them. Tell him/her to pass the tug or squeeze on to all the organisms he/she connects with. Ask those that feel the tug to fall down. Discuss the effects.

5. FIND THE SYMBIOSES: There are other kinds of connections in a forest besides food web connections. Discuss the term "symbiosis." Ask students to find out if the organism they represent needs any living things besides those it eats by reading the information on their card. Ask those whose answer is yes to raise their hands. Locate the symbiotic partners of these students by asking what living thing they need help from, or what living thing can help them. Have the partners stand together in one place and discuss the ways they interact. Discuss each symbiotic connection and the effects on one species of removing its partner from the forest. Repeat until most or all symbiotic associations and partners have been located.

6. STUDENTS EXAMINE THEIR FOREST MODEL TO INSURE THE CONNECTIONS ARE COMPLETE. Students should examine the model they made of the forest in the last lesson. Select an animal from the forest and ask students if it could really survive in their model--does the model include the things that living thing needs to eat, and any other organisms it needs? (Check the Forest Wildlife Card information to find out.) Do this for several animals. Have students add anything that is missing from their forest model.

7. STUDENTS COMPLETE WORKSHEETS AND VIEW THE FILMSTRIP. Reinforce the lesson with the Forest Connections Worksheets 2a and 2b. You may choose to end the lesson by showing the Alaska Wildlife Week filmstrip, Part 2. The Forest Tapestry. It is generally intended for older students, but the previous two lessons have previewed all its major points, so students should be able to understand it and will likely enjoy seeing photos of many of the wildlife that they have been discussing.

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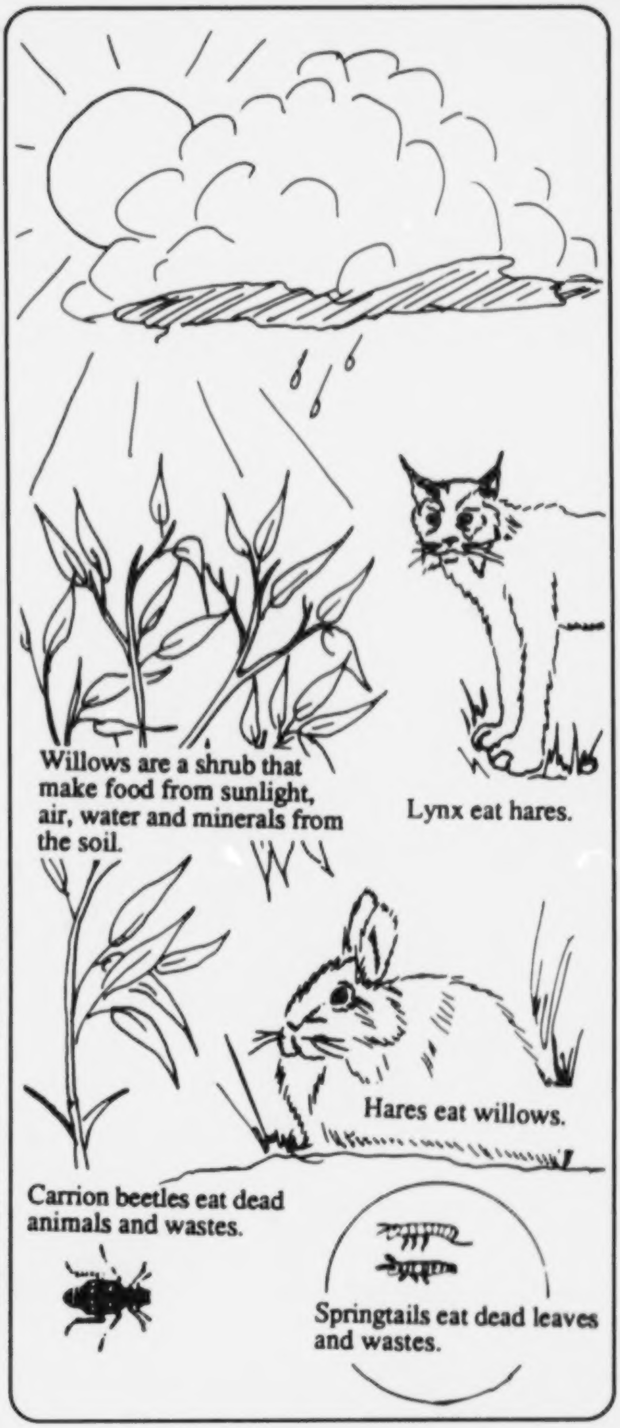
Forest Food Chains Worksheet 3a

Name ____

Each picture below shows some living things that are connected through a food chain. Write the number "1" next to the non-living things in each drawing, a 2 next to the producer in each chain, a "3" next to the herbivore, a "4" next to the carnivore, and a "5" next to the detritivore.



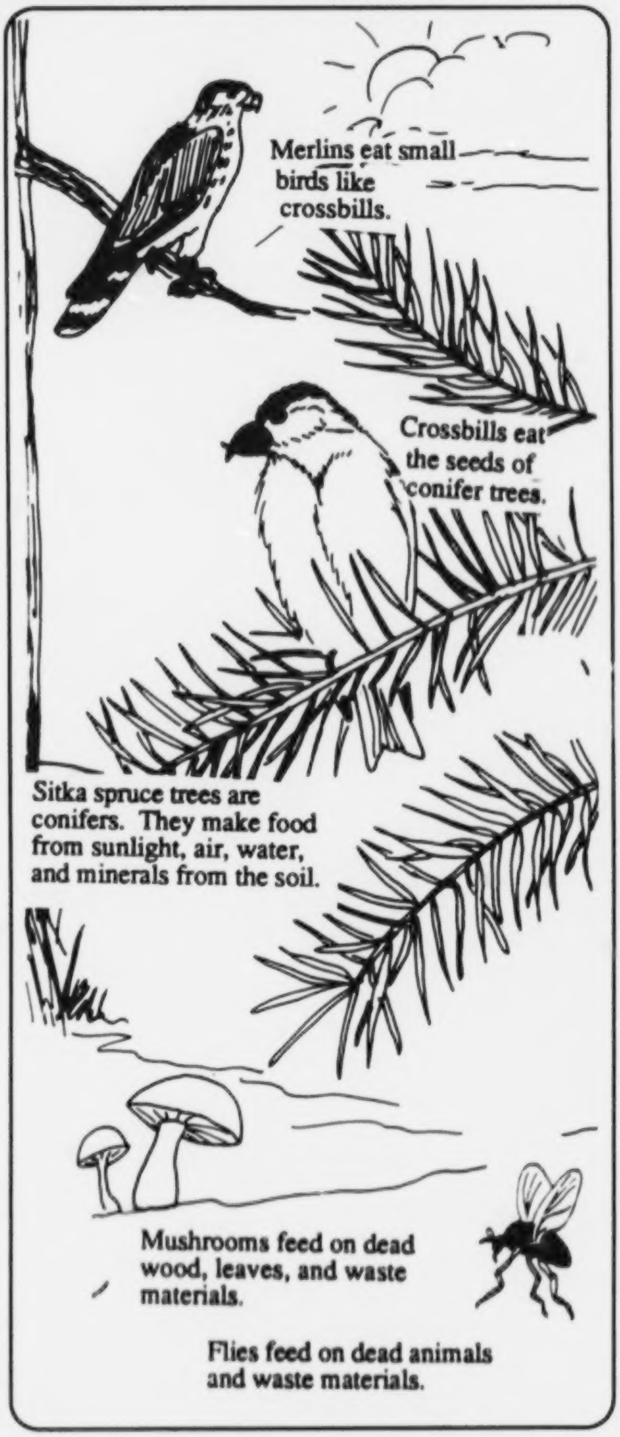
Willows are a shrub that make food from sunlight, air, water and minerals from the soil.

Lynx eat hares.

Hares eat willows.

Carrion beetles eat dead animals and wastes.

Springtails eat dead leaves and wastes.



Merlins eat small birds like crossbills.

Crossbills eat the seeds of conifer trees.

Sitka spruce trees are conifers. They make food from sunlight, air, water, and minerals from the soil.

Mushrooms feed on dead wood, leaves, and waste materials.

Flies feed on dead animals and waste materials.

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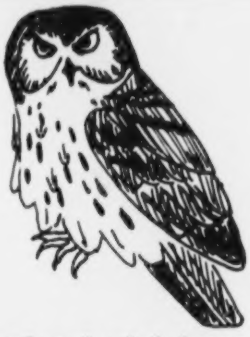
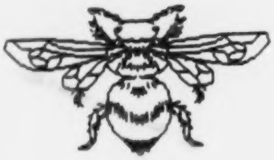
SYMBIOSES
Worksheet 3b

Name ______________________________

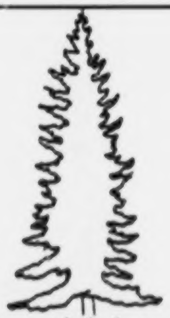
Many living things in a forest need help from other living things. Scientists call this kind of interaction a "symbiosis." Read the information below, and draw a line between the living things that can help each other. These living things depend on each other--they are symbiotic.



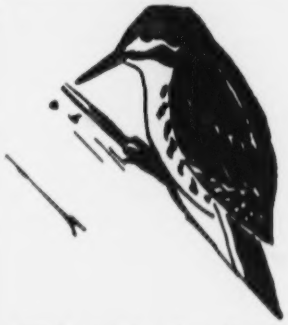
This owl needs a hole in tree trunk in order to nest.



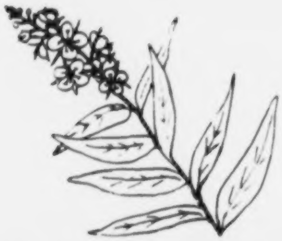
This bee needs nectar to eat. It can carry pollen from one flower to another.



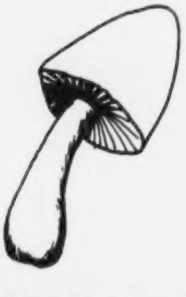
This tree needs help to get minerals from the soil. It will give stored energy to the living thing that helps it.



This woodpecker digs holes in tree trunks.



This flower needs an animal to carry its pollen to another flower. The living thing that helps it can have some of the nectar in the flower.



This mushroom needs stored energy. It can help a plant get minerals from the soil.

Activity Ideas for Curriculum Integration

Lesson 3 **Primary**

ART / SCIENCE **Quiet / Indoors**
Ecosystem in a Tree **Group**

OBJECTIVES: Students will gain an awareness of the components and connections within a forest ecosystem by constructing a model of a tree and the things associated with it.
MATERIALS: Construction paper, crayons or tempera paints, scissors, measuring tape, paper mache´, crepe paper, glue, chicken wire, string or wire; Forest Wildlife Cards and other resource materials on forest wildlife; Optional--tie in with a visit to a museum, see Step 3 below.
PROCEDURE:

1. STUDENTS BUILD A MODEL TREE Have the class build a scale model of a tree out of paper mache´. The model would not have to include the whole tree--perhaps just the lower trunk and branches; they could make it look like it goes on up through the ceiling of the room. (The same kind of display could be made for a dead tree. Divide the class in half and have one group work on a live tree display and one on a dead tree display.)

2. STUDENTS ADD LIVING THINGS TO THIER MODEL: Have students add scale models of living things associated with their tree. Students can read through the Forest Wildlife Cards, other resources, and go examine local trees to get ideas. Some suggestions include: a mushroom (mycorrhizal fungi), a bark beetle (make a cut-away on the tree showing the bark engravings), a woodpecker and its hole, aphids and other insects on the leaves, a warbler eating these, a crossbill eating the cones, a squirrel (with its midden underneath)....etc. Encourage students to include representatives of each kind of thing found in a forest ecosystem (living and non-living, the five kingdoms, producers, and the various types of consumers).

3. If desired, students can make a Nature Guide to their tree, or develop a short talk that explains the various things shown and the interconnections. Perhaps they could invite other classes for a tour. (This could be tied in with a visit to a museum or a movie about a natural history museum: have students imagine themselves as museum curators--building a new display. They could make a tape recorded explanation of the display and make it available to interested students, teachers, or parents.)

SCIENCE **Indoors**
Forest Food Web **Groups**

OBJECTIVES: Students will become aware of the complexity of forest ecosystem connections and the wide variety of living things found in forests.
MATERIALS: Forest Wildlife Cards, bulletin board, yarn, pins.
PROCEDURE: Have students make a bulletin board display using all the Forest Wildlife Cards. They could color in the pictured animals, then use yarn to show the various interconnections. Have them show food web connections with one color of yarn, and symbiotic connections with another color. All the needed information for this exercise is on the text portion of the cards.

MUSIC / SCIENCE **Indoors / Outdoors**
The Food Chain Song **Groups**

OBJECTIVES: Students will become more familiar with forest food chains.
MATERIALS: Forest Wildlife Cards
PROCEDURE: Divide the class into groups and allow each group to make up their own example of a forest food chain. Students should use the information on the forest wildlife cards to insure accuracy in their food chain examples. Each group should figure out ways to act out each organism in their food chain. Have each group lead the class in a rendition of THE FOOD CHAIN SONG, which is sung to the tune of The Farmer in the Dell. The group should act out the various organisms in their food chain as they sing.

The (producer) makes the food...,
the (producer) makes the food...,
Heigh ho the food chain, O!
the (producer) makes the food.

The (herbivore) eats the (producer)...,
the (herbivore) eats the (producer)...,
Heigh ho, the food chain O!,
the (herbivore) eats the (producer).

And so on...Verse 3. (carnivore) eats the (herbivore) and Verse 4. (detritivore) decays the wastes.

Be sure to take your students on

A Forest Learning Trail

It's Fun--Exciting--Educational--Interdisciplinary

The trail guide, a supplement to this packet, was sent to your school library. It contains all the instructions you'll need to guide your students outdoors in an exciting discovery of a forest.

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Lesson 4.

Vocabulary

habitat, carbon dioxide, erosion, oxygen, value, watershed, wood, outdoor recreation

Objectives:

Students will recognize that forests have many values.

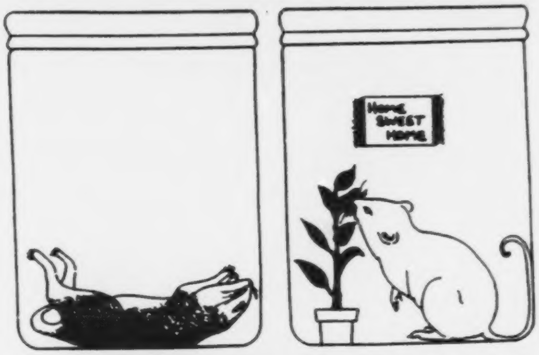
Background:

Forests are valuable for a variety of reasons, including as sources of wood, for their role in cleaning and purifying the air, recharging water supplies, helping reduce flooding and soil erosion, as habitat for wildlife and fish, and as places for outdoor recreation.

SOURCES OF WOOD: Humans have used trees as sources of wood for fuel and as material for building, transportation, and artwork throughout our history. With our advances in technology, we have thought of new uses for wood, such as paper, cellophane, rayon, and in paints, dyes, and sealers. All the wood we use comes either from our own forests, or forests elsewhere in the world. It is almost impossible to look around without seeing some wood products; wood is particularly valuable because it can be used for many things, can be broken down by detritivores or fire, and because we can grow more.

CLEANING AND PURIFYING THE AIR: Forests clean and purify the air in two ways: by removal of dust and pollution, and by removing carbon dioxide and returning oxygen to the air.

Studies have shown that an acre of forest can remove a ton of dust from the air each year. Most of this is trapped by the leaves and branches of trees. Forests also prevent dust from getting into the air by protecting soil from winds.

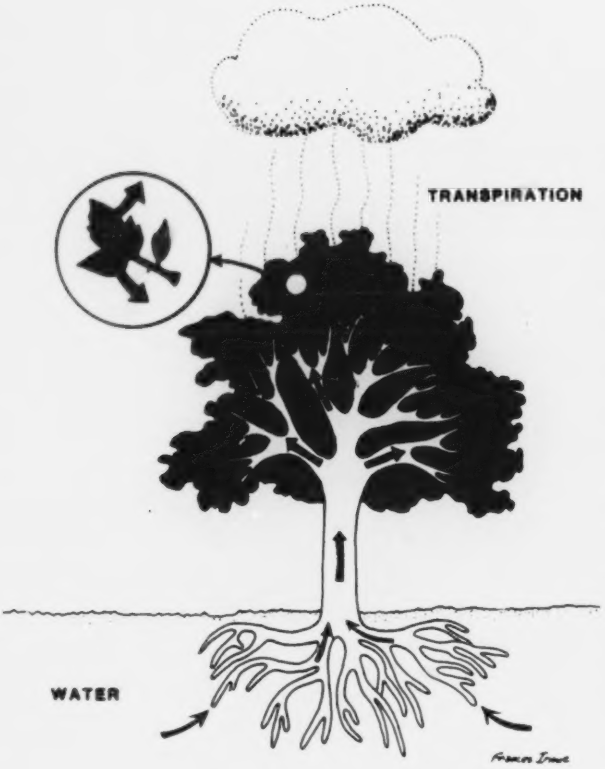


Trees and other producers also renew the air by removing carbon dioxide, the gas we breathe out, and returning oxygen, the gas we need to breathe in. Producers use carbon dioxide and release oxygen in the process of photosynthesis. Humans and other animals, (and producers) do the opposite of photosynthesis (called respiration) when using the stored energy in our foods. We take in oxygen, and give off carbon dioxide.

An experiment by Joseph Priestly in 1772 clearly showed the importance of air renewal by plants. He found that a mouse in a closed jar with food died, but a mouse in a jar with food and a plant, lived. Even a small change in the concentration of oxygen and carbon dioxide in the earth's air would kill humans and most other animals. Some scientists think that forests, especially tropical forests are important in maintaining the proportions of these gases in our air. A forest renews 2-3 times more air than a similar area of grassland or tundra.

FORESTS AND OUR WATER: Nearly all the rain that falls on a forest is actually returned to the air. Much of it is trapped by leaves and branches and then evaporates into the air. Half of the water that reaches the forest soil is also returned to the air, because trees actually pump water from the soil, up through their roots, trunk, branches, and out through their leaves. (This process is called transpiration.) The water that returns to the air helps to form clouds, so forests actually help form the clouds that bring rain and snow. (And, of course, plants could not grow without rain and snow.)

Alaska Wildlife Week Unit 5. Alaska's forests. © 1987 ADF&G



Despite the large amounts of water that forests return to the air, they also help keep our streams and underground water supplies full and clean. Rain water that falls on bare ground erodes soil and minerals and carries these into streams. In contrast, rain that falls on a forest trickles down through leaves and branches, then seeps into forest soil through the spaces made by tree roots, fungi, small mammals, and soil invertebrates. Much of this water is used by plants, but some is stored in the soil. It is this stored moisture that slowly seeps down to fill streams and underground water supplies. Forests are an important part of most Alaskan watersheds. Removal of forests increases the amount of runoff water following storms (which can result in flooding), and lower water levels in streams during dry periods.

HABITAT FOR WILDLIFE: All living things have specific requirements for food, water, cover (shelter from bad weather and protection from predators) and space in a certain arrangement. These needs are called habitat requirements. Most forest wildlife have habitat requirements that can only be met by forests. For example, a red squirrel eats mainly conifer seeds, along with fungi, birds eggs and young. They hide from predators by darting amongst tree branches or hiding in holes in trees. Squirrels can't live on the tundra because there aren't any conifer seeds, or any trees to hide in there. For the same reasons, they can't live long in a large clearing in a forest, either. Research on forest wildlife has shown that most not only need forest, but many need specific kinds or ages of forests.

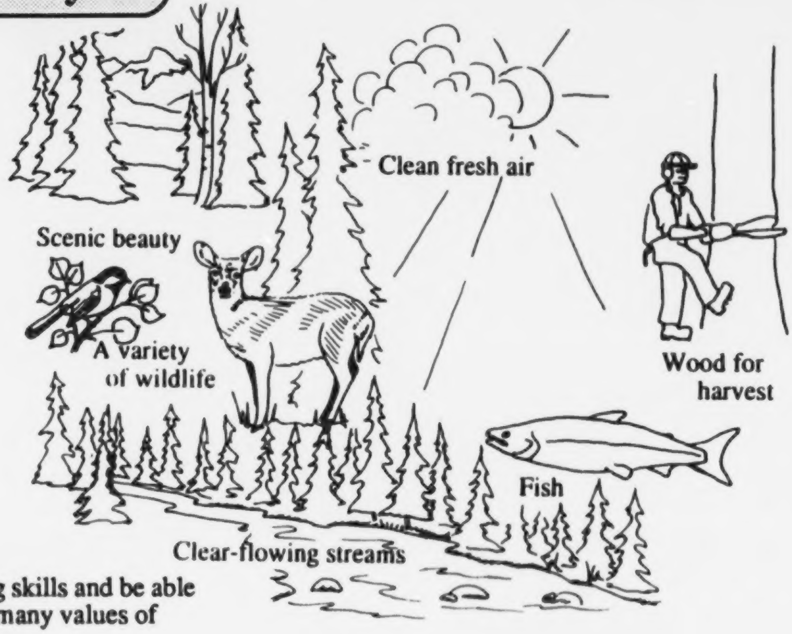
Suprisingly, even some fish need forests. Just like other animals, all fish have special habitat requirements. Just to hatch its eggs, a salmon needs a stream with water that is within a certain range of temperatures, flow, and oxygen content and a stream bottom of gravel within a certain size range. Salmon fry need water within a certain temperature range too, as well as hiding and resting places beneath logs, and plenty of small stream insects to eat. Forests surrounding streams benefit fish by helping keep the streams flowing with clean water. They also shade the stream which keeps the water temperature more stable. The roots of trees and dead trees that fall into streams provide places for fish to rest and hide. And finally, the leaves and twigs that fall off forest plants into the stream provide food for many stream herbivores, like insects. These herbivores are food for fish.

Every kind of plant, fungi, and even microscopic organism has certain habitat requirements, too. Many that live in forests can not survive anywhere else.

FORESTS FOR FOOD: Many people rely on forest wildlife and plants for food or income. People who hunt or fish to obtain food, and those who trap furs for clothing or to sell for income rely on forests for the wildlife they provide. Most of us enjoy picking and eating berries, and for some of us these are an important food source. Many people also harvest mushrooms and other fungi from forests.

FORESTS FOR OUTDOOR RECREATION: Many people value forests as places to hike, hunt, trap, watch birds, or to photograph or study nature. As wild areas around the world are becoming more scarce, and as more and more people are crowded into cities, many people throughout the world are placing a high value on forests as places for recreation. Some people consider Alaska's forests particularily valuable because, for the most part, they have not yet been significantly changed by human activities.

Introductory Activity 4



Objectives:

Students will practice listening skills and be able to describe and recognize the many values of Alaska's forests.

Materials:

Alaska Wildlife Week Filmstrip, Part 4, Dukane projector, or filmstrip projector and tape recorder

Procedure:

1. BRAINSTORM FOREST VALUES: Ask students to name some things that humans get from forests. This will give you a good idea of their present awareness of forest values. Congratulate students on thinking of many things, then explain that they are going to watch a filmstrip that discusses forest values. They should listen carefully to see if the filmstrip lists any values that the class missed.

2. SHOW THE ALASKA WILDLIFE WEEK FILMSTRIP, PART 4. "How Much is a Forest Worth? After it is over, ask students to name some of the values of forests that the class did not orignally think about. List these on the board also. Prompt students to name all the values discussed in the filmstrip.

3. STUDENTS PLAY "KNOCK ON WOOD--A GAME OF FOREST VALUES." Begin the game by explaining that students are to think quickly and if you name something that comes from a forest they should "knock on wood" (tap their knuckles on their desk). But, if you name something that is not from a forest, they must not knock. Then call out some of the items from the list on the board. Students should knock after each one. Once they are in the pattern of knocking after each thing you say, name something that is not from a forest (e.g. oil, a whale, a car, etc.). Any student who knocks must come stand at the front of the room and become a caller. (You may end up with a line of callers--just rotate, with each caller calling out one item at a time.) All the callers may sit down when any student (who remains sitting) makes a mistake and knocks at the wrong time, or if no one knocks when an item that is from a forest is mentioned. (If no one knocks, everyone sitting must stand up.) Those who made the mistake replace the callers.

4. STUDENTS COMPLETE WORKSHEET 4. This worksheet is intended to reinforce the concepts of this lesson.

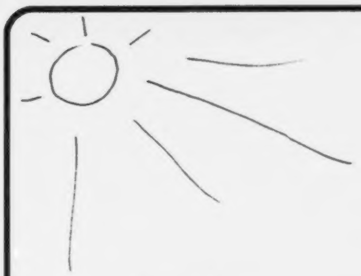
5. EXTENSION: STUDENTS WRITE SHORT STORIES: If desired, have students apply their new knowledge of forest values to write a story entitled "One day in the Life of Alaska Joe (or Josephine)." Specify that their story should include as many references to things that come from forests as the student can quickly think of. For example, "Alaska Joe got up out of his wooden bed one morning and looked out the window of his log cabin. He saw big clouds overhead." Students can make their story as realistic or fictional as they like.

Forest Values Worksheet 4

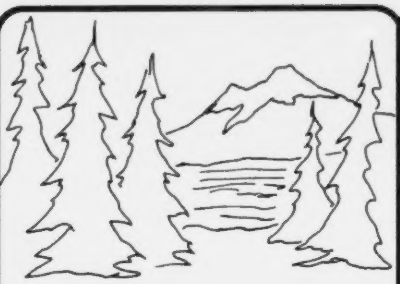
Primary

Name ______________________________

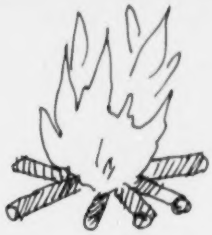
Color in the things that come from forests, or that forests help provide.



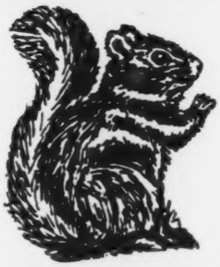
Clean Air



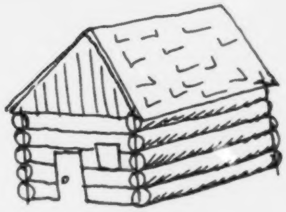
Scenic Beauty



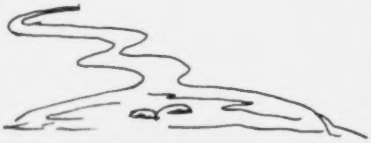
Wood for Heating



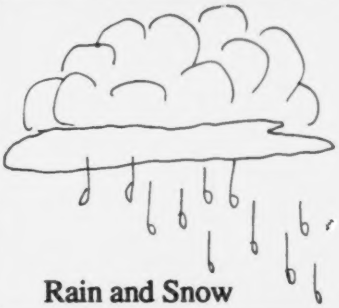
Homes for Mammals



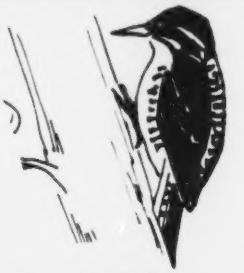
Logs to Build Homes With



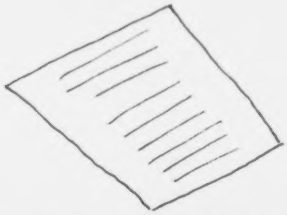
Clean Water



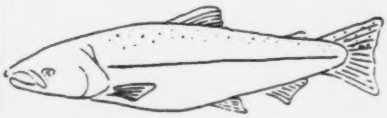
Rain and Snow



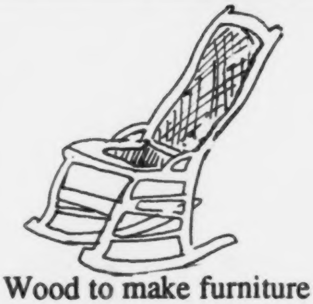
Homes for Birds



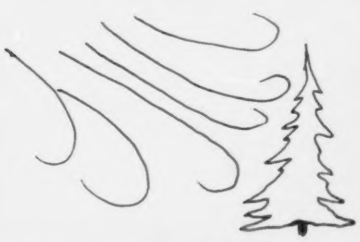
Paper for Books and Writing



Homes for Fish



Wood to make furniture



Shelter from the Wind

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Activity Ideas for Curriculum Integration

Lesson 4 **Primary**

SCIENCE / SOCIAL STUDIES **Indoors**
Experiments in Forest Values **Individual / Group**

OBJECTIVES: Students will better understand the ways that forests affect the air and water, and protect the soil.
MATERIALS: 2 plastic bags, a live plant with branches (and leaves), a dead branch, 2 rubber bands, 2 paint mixing pans, potting soil, grass seeds, plastic wrap or 2 large, clear plastic bags, a sprinkling can, 2 medium-sized jars with tight lids, fruit flies or other insects, 2 small plants, 2 pieces of fruit.
PROCEDURE:
1. STUDENTS SET UP EXPERIMENTS: 1. Have students put a plastic bag around 1 branch of the live plant, and another over the dead branch. Seal the bags shut around the branches using the rubber bands. Place both the live and dead plant in the sun. (Be sure that you have recently watered the live plant.) 2. Have students fill the sloping parts of the two paint pans with very moist potting soil. Spread the seeds of the grass, or other plants, thickly over the soil in one pan only. Cover the pans with plastic wrap or a large plastic bag and place in a warm, sunlit place. 3. Have students place 1 piece of fruit in each jar. Place the live plant in one jar. Then, release several fruit flies in each jar and close the lids tightly.
2. STUDENTS MAKE OBSERVATIONS: Students should observe each of their experiments for several days. They should make the following observations: 1) Water will appear inside the bag around the branch of the living plant , but none will appear inside the one around the dead branch. Have students figure out why this happened. (Plants pump water from the soil into the air.) 2) The seeds should germinate and grow. Once the grass is well established in the one paint pan, indicate to students that the grass in the pan represents a forest of trees and other plants on a hillside. Demonstrate the effects of rainfall by sprinkling water over the two pans. Less soil will be washed down the "hillside" in the "forested" pan. Have students discuss why. 3) Students should count the numbers of live and dead fruit flies in each jar over several days. (Their numbers should increase if they reproduce.) After several days, the flies in the jar without a plant will begin to run out of oxygen and will die. Have students discsuss why the flies in the jar with the plant lived longer than those in the jar with no plant. (Caution: fruit flies are short-lived, so some of those in the jar with the plant will die also. However, as long as they have food, they should continue to reproduce, so live ones should remain.)
3. STUDENTS COMPARE THEIR EXPERIMENTS TO THE WORLD AROUND THEM: Ask students to think about each experiment: 1) If the single branch of the live plant put water into the air, how much water might a tree put into the air (80 gallons or more per day!). How much might a large forest put into the air? What happens to the water that forests put into the air? (It helps form clouds, and thus rain and snow.) What if all the forests were cut down or cleared? Would that be good or bad? 2) How did the "forest" protect the soil of the hillside? What happens to the soil when forests on steep hillsides are removed? Can new trees be grown if all the soil is washed away? 3) Why did the fruit flies in the jar with no plant die--they had plenty of food. Do students recognize that the flies ran out of air to breathe. Compare the earth's atmosphere to the air in the jar--only our jar is the surrounding space. Why do astronauts have to wear space suits? What would happen to us if we killed all the forests and plants on earth? (We'd run out of air to breathe.)

Alaska Wildlife Week Unit 3: Forests © 1987

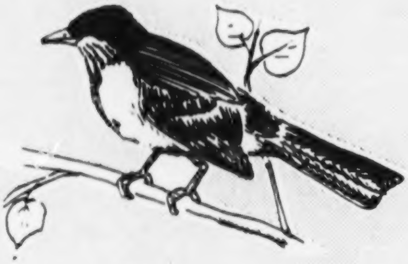
LANGUAGE ARTS **Indoors**
Forest Stories **Individuals/ Groups**

OBJECTIVES: Students will practice reading skills and be able to identify the forest values portrayed in juvenile fiction books.
MATERIALS: Juvenile fiction books on forests or in a forest setting.
PROCEDURE:
1. STUDENTS SELECT AND READ BOOKS: Have students select fiction books to read that discuss forests or are set in forests. Have them read the story, then answer the following questions about the story:
  a) How was the forest portrayed in the story? (as dark and forbidding, or friendly and interesting, important or unimportant)
  b) What was the relationship between humans and the forest in the story?
  c) Was the forest in the story imaginary or realistic?
  d) What values did the forest in the story have? According to the story, which value or values were most important?

Suggested juvenile book:
The Lorax, by Dr. Seuss

SOCIAL STUDIES / SCIENCE
Mixed / Indoors / Outdoors **Group**
Wood in Our Lives

OBJECTIVES: Students will practice observation skills while becoming more aware of the variety of ways that we use wood.
MATERIALS: Paper, pencils.
PROCEDURE:
1. Divide the class into groups and have these groups survey the school and make an inventory of the following things: 1) things made of wood or wood by-products and 2) things made of other materials that could have been made of wood.
2. Compare the lists of various groups. Who found the most variety of things. Was anything made of wood missed by everyone. (Check the encyclopedia for a list of wood products.) Discuss the pros and cons of using wood for various purposes. (PRO: wood is strong and light-weight; more trees can be grown; wood decays and breaks down; CON: we do not have unlimited supplies; trees that are cut down for wood are not available for other values or uses.) Discuss which uses of wood are necessary, and which are uneccessary and wasteful.



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Lesson 5.

Vocabulary

forester, forest management, forest manager, non-renewable, renewable

Objectives:

Students will recognize that humans can do things to help or harm forests.

Background:

WORLDWIDE FOREST LOSSES: Forests once covered 2/3 of the land on earth. Today, due to human activities, they cover less than 1/4.

The major cause of forest loss worldwide is the growth of the human population, which is growing by an estimated 9,000 people per hour. Human demands for wood for fuel and building material, and for land for agriculture, homes, and industry are thus also growing rapidly in many parts of the world. Vast numbers of trees are being cut down for firewood and building materials, and huge areas of forest land are cleared without any thought about protecting the soil, planting new trees, or about where people will get wood, or other forest resources in the future.

Another cause of forest loss elsewhere in the world, particularily in northern Europe, Canada, and the eastern U.S. is air pollution. Many of the chemicals released by car exhausts, and by industries and power plants weaken or kill trees.

ALASKA'S FORESTS: In Alaska, we still enjoy the many benefits of large forest expanses, including clean fresh air, clear-flowing streams full of fish, as well as wildlife for harvest, photography, and enjoyment, and a ready supply of wood for fuel, building, and other uses. However, our demands for all these forest uses are growing.

As our needs for and uses of Alaska's forests grow, we are changing our forests. Logging, firewood cutting, road construction, starting and putting out fires, mining, recreational use, air pollution and other activities all affect our forests. As we use and change our forests, we must all be very careful to ensure that we do not irreparably harm them, so that we and future generations of people can continue to enjoy their many benefits. If we use our forests carefully, we can avoid the loss of forests that is occuring elsewhere in the world.

FOREST MANAGEMENT: The art and science of balancing use and protection of forests, is called forest management, and those who practice it are called FOREST MANAGERS, or FORESTERS. Forest managers work to protect forests from careless use, and thus help to prevent the loss of valuable forests.

Foresters recognize that trees are a RENEWABLE RESOURCE. Unlike NON-RENEWABLE RESOURCES like coal, oil, and gas which once used are gone forever, trees can be cut down, and then new ones grown in their place. However, it takes many years to grow new trees, and cutting down trees changes the forest. So forest managers must know a lot about forests, about how cutting down trees will affect the forest, and about growing trees.

If trees are cut down in the wrong places, such as on steep slopes, the soil will erode away; new trees can't be grown without soil. If too many trees are cut along stream banks, it can cause changes in the stream that will harm fish, such as siltation, or water flow changes.

If too many trees are cut down, or too large an areas is cut, there won't be any trees left to spread seeds in the cleared area, so trees won't grow back naturally. If all the dead trees in a forest are cut down, the animals that need dead trees, like woodpeckers, chickadees, and flying squirrels won't have any place to live. Also, people like to hike, hunt, and enjoy nature in forests. Many people do not enjoy these activities in areas that have been logged.

So, forest managers must plan use of forests carefully, in order to ensure that they can grow new trees, to protect streams and wildlife habitat, and to ensure that people have forest areas for recreation. Foresters decide what trees can be cut and when, and what trees should not be cut by considering all these problems.

HOW YOU CAN HELP ALASKA'S FORESTS: Most of the forests in Alaska belong to you and me; they are on public land. Thus, each of us shares in caretaking of our forests. In a way, we are all forest managers. We can help to ensure the future of our forests in many ways.

By Helping Forest Managers: Forest managers need information about forests and about people's uses of forests in order to manage them wisely. We can help foresters do a good job by supporting research on forests, and by participating in public meetings about forests.

Forest managers think very carefully about what trees in a forest to cut and which to protect. People who cut down trees for firewood or other uses in places where they do not have permits, can hurt the forest and its wildlife. The trees they cut down may have been set aside for wildlife habitat, or to protect streams and water, as a source of seeds for future trees, or for cutting another year. We can all help forest managers by learning what trees are designated for cutting, using only those and reporting people who break the rules.

By Preventing Human-caused Forest Fires: Starting forest fires is against the law because human-caused fires can hurt our forests, watersheds, and wildlife. Lightning-caused fires are a natural part of forest ecosystems and usually perform a valuable function. However, forest fires also can destroy valuable forests and can threaten human lives and property. Forest managers have developed careful plans for managing natural forest fires to try to balance beneficial and harmful effects. Foresters monitor all fires carefully, and decide which should be allowed to burn, and which should be controlled, or put out immediately. Human-caused fires make fire management more difficult; also the required fire suppression efforts cost money and may cause soil erosion or other problems.

By Conserving Wood and Paper: Careless use of wood and wood products also harms forests. All of the 135,000 tons of paper and 100 million board feet of lumber we use each year comes from forests. When someone wastes paper or wood, they are wasting the trees and forest that paper or wood came from. By re-using and recycling paper and wood, we can reduce the number of trees that have to be cut down. We can also reduce the amount of wood we burn by using wood stoves that burn efficiently. Most foresters agree that the demand for wood and paper is growing too fast, and our forests won't be able to supply all the wood and paper we want in the future. We just can't grow trees fast enough, so we must limit our demand.

By Recycling and Reducing Air Pollution: Recycling paper and aluminum helps reduce air pollution that harms trees. Each ton of paper made from waste paper rather than new wood reduces energy use by 1/3 to 1/2 and air pollutants by up to 95%. Aluminum produced from recycled cans rather than new ore cuts emissions of chemicals that harm trees (nitrogen oxides and sulfur dioxide) by over 95%. We can also reduce air pollution by not wasting electricity or fuel.

By Treating the Forest Gently: Little things that we do can also help or harm forests. Litter is not only ugly, but some kinds also harm forest animals. Monofilament fish line often entangles animals and causes them to die of starvation. The plastic holders for 6-packs of pop also entangle and kill wildlife. Some animals mistake the flip-tops from pop cans for food and eat them; this can injure or kill them. We can help forests and forest wildlife by not littering, and by picking up litter thrown out by unthinking people.

Cutting off branches from trees and making blaze marks with hatchets or knives may not kill a tree immediately, but it does injure them. These injuries provide an opening in the bark that allows insects and diseases to enter a tree. Thus, trees can eventually die as a result of injuries caused by careless people.

To ensure forests and their many values for the future, everyone of us must become a caretaker of Alaska's forests.

Introductory Activity 5

U.S. F.W.S.

Objectives:

Students will recognize that we can each do things to help or harm forests, and we must be careful with forests s that we can continue to enjoy their many benefits.

Materials:

The forest model constructed in the Introductory Activity 2, Forest Action Cards (see following pages), Worksheet 5, Optional: A Forest Learning Trail (supplement to this packet--check your library).

Procedure:

1. REVIEW THE VALUES OF FORESTS USING THE FOREST MODEL: Use the forest model students constructed in Introductory Activity 2 to reiterate the many values of forests.

2. STUDENTS CHANGE THEIR FOREST: Give each pair of student a Forest Action Card. Each of these describes a particular thing that people do that affects forests. Ask students to come up and pretend to do the activity described on the card. (For example, if their card says: Some people leave cans, paper, and other trash in the forest--the student could go get a piece of trash and toss it into the forest model If the card says, "Some people cut down trees so they can use the wood to heat their homes," the student should remove some of the trees from the forest model.) Allow students to continue pretending to do these activities until their forest model is messed up (littered, most of the trees removed, etc.) Then, ask students to quit pretending and stop and look at what they have done to their forest.

3. STUDENTS DISCUSS THE EFFECTS OF THEIR ACTIONS: Have students discuss how their forest model has changed. Are these changes good or bad? How do these changes affect the values of the forest. Does it still clean the air and water when all the trees are gone? Does it still provide homes for forest wildlife? Is it a beautiful place to hike? Explain that many forests around the world have been and are being destroyed by people.

4. STUDENTS EVALUATE HUMAN ACTIONS: . Ask each student to re-read his/her card and decide whether the action helps or harms forests. Write two columns on the board: 1) Things that help forests, 2) Things that harm forests. Have each student come up to the blackboard and read the card they are holding. Then ask them to stand under the column they think that activity belongs in. If the class agrees, then write the action under that column.

When all students have come up and classified their action, discuss what should be done about the activities that harm forests. Should they be against the law? Allowed to continue? What if people were not allowed to do this activity anymore? Would anything else be affected? (For example, raise the question of whether humans could survive without wood to heat homes, to build homes and furniture, without paper to write on, metals to make machines, etc.) Students should recognize that some of the activities may be necessary for people to continue living the way we do. Ask students how we might be able to prevent losses of our forests and still have wood, and get other resources.

Help students come up with the ideas of
1) planting new trees in disturbed areas,
2) limiting tree harvest and other necessary, but harmful activities, to certain parts of the forest to prevent soil erosion and to protect streams and wildlife habitat, and
3) reducing our use of resources that come from forests by not wasting them, and by recycling.

Compare the use of wood to use of other resources such as oil and gas. (Wood is renewable; if we protect the soil and the environment, we can grow more wood. We can't grow any more oil.) Then, add a third category to the board: "Things We Must Do Carefully"; help students recognize that wood harvest activities should be listed under this category.

5. DESCRIBE PUBLIC OWNERSHIP OF ALASKA'S FORESTS AND THE JOBS OF FOREST MANAGERS. Explain that most forests in Alaska belong to the public--that is everyone, including them. The managers of Alaska's public forests, are called foresters, or forest managers. They are responsible for making sure that forests are conserved--which means used wisely, or taken care of. Discuss why forest managers need lots of information about forests, and must think very carefully about which trees should be cut down, and which trees should be left in a forest (see the Background Information). Discuss why foresters often make regulations about uses of the forest and tell people where to cut wood, where to camp, etc. Discuss ways that students could help forest managers take care of forests. Add obeying regulations on forest use, learning more about forests, and helping forest managers, to the list of ways people can help forests.

6. STUDENTS COMPLETE WORKSHEET 5 AND TAKE A FOREST LEARNING TRAIL HIKE: Evaluate student understanding of the lesson by having them complete Worksheet 5. If you have not already taken your class on the Forest Learning Trail (see the supplementary materials sent to your school library), select some stations from the Trail Guide, and lead your students outside to explore a forest. This will provide students a fun conclusion that reinforces most of the lessons in this unit on forests.

7. EXTENSIONS: The Curriculum Integration Section includes ideas for some activities that will help students tie together what they learned about forest conservation with personal responsibilities and local forests.

Forest Action Cards

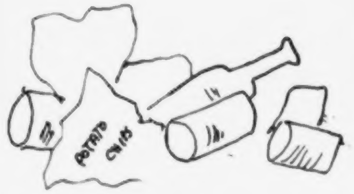
Some people cut down trees to get wood to heat their homes.	Some people cut down trees in order to make clearings for farms and to build cities.	Some people leave papers, cans, plastic, and other trash in the forest.
Some people are careless with fires and cause forest fires.	Driving cars around and burning fuel puts a kind of smoke, or pollution, in the air that can kill trees.	Some people cut down, or harvest, trees so that we have wood to use in making paper.
Some people drive cars, trucks, or three-wheelers through forests. This kills some of the trees and other plants.	Some people camp in the forest.	Some people build houses in the forest.
Some people make a lot of noise in the forest and scare forest animals.	Some people mine for metals in the forest. They have to remove the trees and soil.	Some people build roads in the forest. They have to cut down trees to do this.
Some people pick up litter that others left in the forest.	Some people kill all the animals they see.	Some people break off the branches of trees.
Some people plant trees in areas where the trees have been cut down or cleared.	Some people cut down trees to make totem poles, build canoes, or make furniture.	Some people cut off the bark of trees in order to get the materials needed for making beautiful baskets.
Some people are very careful about their uses of paper, and always recycle it.	Some people only drive their vehicals on roads or trails so they won't harm growing plants.	Some people are always careful with their campfires, and always put out all the sparks and coals. This helps prevent forest fires.
Some people put out forest fires started by careless people.	Some people use special kinds of stoves and cars that do not pollute the air as much as other kinds.	Some people are quiet in the forest, and always careful. They try not to break off tree branches, or trample the plants.

Primary

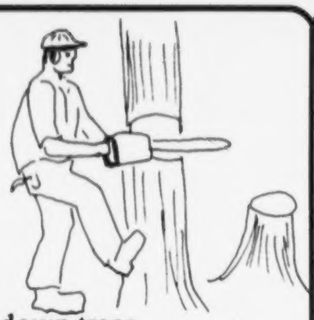
Forest Friends Worksheet 5

Name ______________________________

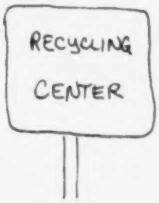
Color in the things that you can do to help a forest. Place a C over those things which you should do carefully and only in certain areas. Place an X over those things which harm the forest and which you should never do.


POTATO CHIPS

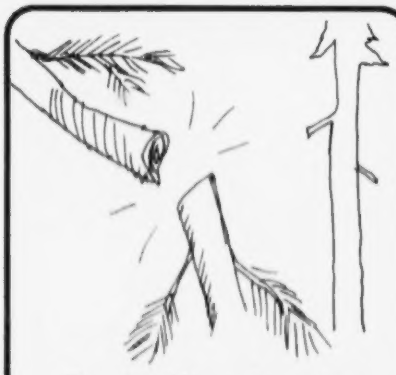
Leave paper and cans on the forest floor



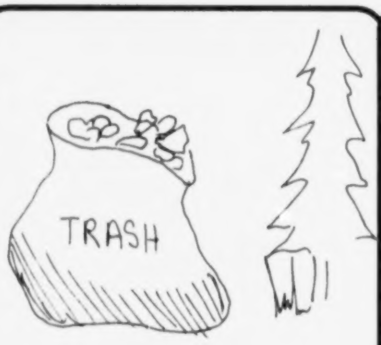
Cut down trees to get wood for heating and building


RECYCLING CENTER

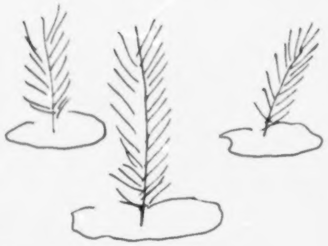
Use paper carefully and recycle



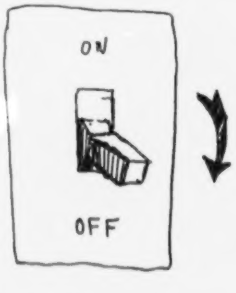
Break off tree branches



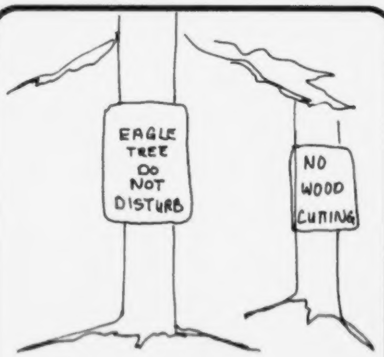
Pick up litter



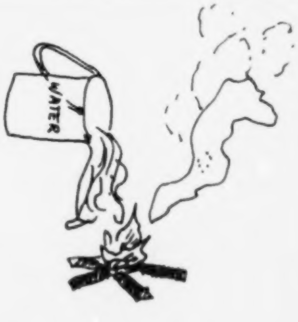
Plant trees in disturbed areas



Conserve energy


EAGLE TREE DO NOT DISTURB
NO WOOD CUTTING

Obey forest rules



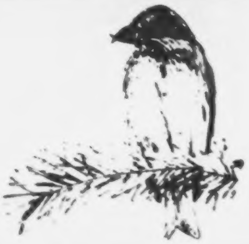
Prevent forest fires.

Activity Ideas for Curriculum Integration

Lesson 5 **Primary**

LANGUAGE ARTS Indoors
Legends of the Forest Individuals

OBJECTIVES: Students will practice creative writing skills while reinforcing their understanding of the importance of using forests carefully.
MATERIALS: Examples of legends or fables that teach a moral (e.g. Native legends, Aesop's fables, Greek or Roman Mythology).
PROCEDURE:
1.HAVE STUDENTS READ EXAMPLES OF FABLES, MYTHS, OR LEGENDS. Discuss the characteristics that these stories share. (They tell of past events, either imaginary or fictionalized, often include imaginary characters, and teach a moral, or lesson that may be of value to the reader.)
2. HAVE EACH STUDENT WRITE THEIR OWN LEGEND that will teach readers the importance of using our forests carefully, so that we will be able to enjoy the benefits of forests in the future.



SOCIAL STUDIES / LANGUAGE ARTS
Indoors
Forest Managers Individuals

OBJECTIVES: Students will practice listening and questioning skills while becoming more aware of the job of resource managers.
MATERIALS: a local resource manager to come to your class
PROCEDURE: Invite a local resource manager to come to your class to discuss forest management. (You could ask someone from the Dept. of Natural Resources--Lands or Forestry Divisions, the Alaska Dept. of Fish and Game, U.S. Forest Service, Bureau of Land Management, or U.S. Fish and Wildlife Service.) Ask these individuals to prepare a short talk to present on the importance of forest conservation, and to be prepared to answer student questions. Ask each student to write down one question about forests and their management for which they would like to know the answer, and be prepared to ask this question of the guest speaker.

SOCIAL STUDIES / ART Indoor
Forest Friends Individuals

OBJECTIVES: Students will think about their personal responsibilities to care for Alaska's forests.
MATERIALS: None
PROCEDURE:
1. DISCUSS THE OWNERSHIP OF ALASKA'S FORESTS. Ask students what they should do with things they own--such as a plant, a pet, a yard, or a garden. (They should recognize that they have to take care of these things.) Review the fact that nearly all of the forests in Alaska belong to the public--and that includes them. What should they do since they own the forests of Alaska?
2. HAVE STUDENTS THINK OF THINGS PEOPLE DO THAT AFFECT FORESTS: Encourage students to brainstorm activities that people do that might affect forests--that either help or hurt them. (Use the background information for direction and additional ideas.) Have students discuss each activity and decide whether it helps or harms forests. Then discuss whether those things that harm the forest should be allowed, but controlled, and which should not be allowed at all.
2. DISCUSS HOW STUDENTS COULD HELP FORESTS: Discuss whether students do some of the listed activities. Do they do any of the things that help forests? Any of the things that harm forests? Do they do anything that requires someone else to do an activity that harms a forest?
3. HAVE STUDENTS WRITE A PLEDGE FOR FRIENDS OF FORESTS: Discuss the idea of a pledge (the pledge of allegiance or scout's pledge could serve as examples of pledges). Ask students to write what they think would be a good pledge for a "Friends of Alaska's Forests Club." As an ART EXTENSION, have students make a button or patch for members of the Friends of Forests Club.

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TEACHING ACTIVITIES

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* U. S. Forest Service. **Miscellaneous** posters, booklets, brochures, and other material on trees and forests; most are designed for national use. *Contact: Wanita Williamson, U. S. Forest Service, Alaska Region, P.O. Box 1628. Juneau, AK 99802.*

ALASKA WILDLIFE WEEK 1987
UNIT 5. ALASKA'S FORESTS--MORE THAN JUST TREES.

Educational Packet:
Teacher's Guide,
Wildlife Poster,
Forest Wildlife Cards,
A Forest Learning Trail,
A Forest Game,
Filmstrip Series.

Published by: Alaska Department of Fish and Game
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BEST COPY AVAILABLE

A FOREST LEARNING TRAIL

A Supplement to the 1987 Alaska Wildlife Week Educational Packet
Unit 5. Alaska's Forests.

Chinese Proverb:
I hear, and I forget.
I see, and I remember.
I do, and I understand.

Students are likely to learn more and be more excited about the concepts of forest ecology if they visit a forest. Set up a Forest Learning Trail in an area accessible to your school and guide students in discovery. The trail includes 21 stations of interdisciplinary activities, including language arts, social studies, science, math, and art. Along the trail students will observe, measure, infer, identify, and predict--while learning about and applying their knowledge of forest ecology.

HOW TO SET UP THE TRAIL

Several classes can use the same Forest Learning Trail, so it only needs to be set up once. One teacher or a small group of teachers can set the trail up ahead of time. Place learning stations in sets of 3-4, and divide your class into small groups. In this way, one leader can monitor the activities of 3-4 student groups at one time.

Each of the following pages describe the learning stations for placement on the trail. The top part of each page explains how you can set up that learning station. Cut off the lower half and place it at the station; students read this section and follow the directions given. (You may choose to use all the cards at once for a half-day or day-long trail, or use different groups of cards to set up different trails for use on separate days. You can also select out those cards relevant to the various sections of this unit, or those most usable with your students.)

Each student, or group of students, should have a cardboard clipboard or field notebook made up before taking the Learning Trail, so each can record answers to questions and keep notes.

PRE-FIELD TRIP ACTIVITIES:

Pages 2-3 suggest activities for use just prior to beginning the Learning Trail. The first activity will help burn up excess energy and thus help energetic students calm down enough to pay attention along the trail, and the second will help students get focused on and interested in discovering the forest.

WARM-UP ACTIVITIES

In addition to making sure students wear warm clothing suitable for the weather of your area, you may want to plan an active game at the start, middle, and end of the trail to help students stay warm and interested in something besides their cold feet. You can choose from some of the active games described in the intercurriculum activities of each section, or use active games from other sources. Tie any game into the forest by naming the teams using forest terms, forest wildlife, or ecosystem concepts.

POST-FIELD TRIP ACTIVITIES

The Sharing Station (page 18) is a good end to the trail. Have the entire class gather together and share their impressions of the forest. The CLASSROOM FOLLOW-UP section of each activity suggests things to do once students are back in the classroom. Use of these will enhance the value of the outdoor experience.

PRE-FIELD TRIP ACTIVITY 1.

LANGUAGE ARTS/ MUSIC/ PHYSICAL EDUCATION

Active **Outdoors**

FOREST BIRD SONGS TAG **Groups**

OBJECTIVES: Students will practice listening skills and learn to recognize the songs of forest birds common in your area.

MATERIALS: Tape recorder, tape recorded songs of forest birds--follow directions below, and an open area to run in.

PROCEDURE:

1. MAKE A TAPE RECORDING OF BIRD SONGS: There are a variety of records and tapes of bird songs available. Check with local libraries, museums, or birdwatchers to borrow a copy, OR purchase a copy of "Bird Songs of North America" from the National Geographic Society, or " A field guide to western bird songs--Peterson Field Guide Series" ($27.50 from the The Crow's Nest Bookshop, Cornell Laboratory of Ornithology, 159 Sapsucker Woods Road, Ithaca, New York 14850.)

a. Record 6-8 songs of common forest birds (see lists at bottom of page) along with the announcements of the birds' names on your tape. This portion of your tape will be used to teach students the bird songs.

b. Record several repetitions of these songs (without the name announcements) in a mixed order. This portion of your tape will be used to play the game when you reach the fieldtrip spot.

2. REVIEW THE BIRD SONGS WITH STUDENTS: This should be done in class before the trip, then repeated in class or on the bus trip, immediately before going into the field. You will want students to be pretty good, but not perfect, at recognizing the bird songs on your tape.

3. PLAY BIRD SONG TAG.

a. Divide the class into two teams, the Hawks and the Songbirds.

b. Place out markers showing the home base of the hawks, the home base of the songbirds, and a Home Free spot. (Place these in a triangle at whatever distances apart you feel are appropriate for your students.) Have each team stand on or near their home base.

c. Explain the rules of the game:

--You will call out the name of a bird, then play the birdsong tape.

--All students must listen carefully. When the song of that bird is played, the Songbirds must run towards the Home Free base, and the Hawks must chase them.

--If a Songbird gets to the Home Free spot without being tagged by a hawk, they survive and return to the Songbird Home Base. If they are tagged, they become a Hawk.

--If a Hawk catches a Songbird to eat, they remain a Hawk and return to the Hawk home base with their prey (who becomes a Hawk). If a Hawk does not catch a Songbird--they die, their minerals are returned to the soil, and are taken up by a plant whose seeds are eaten by a Songbird--in other words, starved Hawks become Songbirds.

--If either a Songbird or a Hawk runs out at the wrong song, they have to return to their home base and take 2 big steps backwards (that is, move farther away from the Home Free base).

--The team with the most players at the end of the game wins. (The game ends whenever you say so.)

d. Play it!

3. NOW THAT STUDENTS CAN RECOGNIZE BIRD SONGS, ASK THEM TO TRY TO BE QUIET AND LISTEN FOR THESE BIRDS ALONG THE FOREST TRAIL.

SUGGESTED BIRD SONGS-BOREAL FOREST

any woodpecker of Alaska (chirp and drumming)
Gray Jay
Common Raven
Black-capped Chickadee
Common Redpoll
Pine Grosbeak
Willow Ptarmigan

SUGGESTED BIRD SONGS-COASTAL FOREST

any woodpecker of Alaska (chirp and drumming)
Common Raven
Northwestern Crow
Steller's Jay
Chestnut-backed Chickadee
Pine Siskin
Winter Wren
Blue Grouse (April- May only)
Varied Thrush (April - June only)

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PRE-FIELD TRIP ACTIVITY 2

SCIENCE
Active
FOREST MYSTERIES

Outdoors
Groups

OBJECTIVES: Students will practice using their hearing, seeing, smelling, and feeling senses while attempting to identify objects from the forest.

MATERIALS: Small box, large box, tape recorder, and items selected from the forest students will visit, small contest prizes; Suggested Items: Visual: bark of a tree, lichen, twig browsed by a hare, moose, or deer, leaf, a piece of a feather, other animal sign; Tactile: tree bark, conifer branch, shelf fungi; Auditory: short tape recording of bird song or call, wind in trees, footsteps in snow, dripping water; Olfactory: conifer branch, leaf litter, poplar or cottonwood branch (if sap running), rotting wood, skunk cabbage.

PROCEDURE:

1. SELECT MYSTERY ITEMS AND SET UP STATIONS: Select one item for each of the five senses from the list above or others you find while setting up the trail. Place each of these items at a separate station in your classroom or in a hallway. The visual items can just be laid out on the table. Place the olfactory item in a small box with holes punched on all sides. (Be sure you put enough of the olfactory mystery object inside that it overwhelms the smell of cardboard.) Place the tactile item(s) in a large box with holes large enough for hands to reach inside and cloth covering openings to prevent students from looking. Have someone run the auditory station by playing the tape recording for each student or group of students.

2. STUDENTS VISIT STATIONS: Just prior to your field trip (no more than one day ahead), tell students they are going to need to use their senses carefully in order to solve several forest mysteries. Indicate that there are four (or more) secret items that were brought back from the forest they are going to visit. Ask them to visit each station and observe the secret objects carefully. Then, while they are in the forest, they should keep their eyes, ears, noses, and hands awake and observing carefully so they'll notice if and when they come across a secret object. If they do, they should make a note of what it is to themselves or write it down in their notebook. They should not tell anyone else. Explain that when they return to class later, there will be a contest to see who has solved the forest mysteries.

3. HAVE STUDENTS TAKE THE FOREST LEARNING TRAIL

4. HOLD A CONTEST TO IDENTIFY THE SECRET OBJECTS: Allow students to re-examine the secret objects (if desired), then ask them to write down what they think each item is on a piece of paper with their name. Ask what students thought each item was and see if there is a class consensus. Then reveal the item and its correct identity. Repeat for each item--then give 4th place awards to those who got 1 item correct, 3rd place to those who got 3 correct, and so on. [These awards can be tangible (such as a balloon), or intangible (such as getting to go to lunch first).]

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Forest Views—Preparation

This station can be placed anywhere along the trail. A spot with good places to sit will make it more comfortable for students to write. Make enough copies of the lower part of the instruction card, so each student in a group will have their own. Select cards of animals that occur in your area from the Forest Wildlife Card set. Include one insect and/or small mammal that lives in or on the soil (ant, springtail, shrew, vole), one animal that is fairly close to human height (deer, moose, bear), and one animal that lives in the tree tops (flying squirrel, crossbill).

Skills: observing, imagination, creative writing
Subjects: Science, Language Arts
Materials: several copies of the instruction cards, selected Forest Wildlife Cards

Forest Views—Instructions

1. Write the heading "Forest Views" at the top of the next page in your notebook.
2. Take one Forest Wildlife Card and one Forest Views Card for yourself. Find a good spot to sit, and look carefully at the forest around you, and follow the directions on your Forest Views Card.

FOREST VIEWS

1. Read your Forest Wildlife Card so you know something about the animal it shows.
2. Imagine now that you are that animal, and you live in this forest. Imagine you are living wherever your animal lives and looking through its eyes as you look around.
3. Write in your notebook: I am a forest animal.
4. Write 1 or more complete sentences to answer each of the following questions:
   a. Exactly where are you and what are you doing?
   b. What do you see, feel, smell, or hear within a few inches of your nose, bill, or snout? Describe the sizes of the things around you, their colors, textures, and shapes.
   c. What do you see on all sides of you if you look outward a distance of a few feet?
   d. What do you see if you look out as far as you can see? (Describe the distance, colors, and textures of your view.)
   e. You just spotted a predator--describe it, where it was when you spotted it, and how you narrowly escaped it. (Then record the name of the animal you imagined yourself to be.)
   f. When everyone in your group has finished, move on to the next station. If you finish before others, just enjoy listening and watching the forest around you.

CLASSROOM FOLLOW-UP: Have students read their essays aloud and see if their fellow students can guess what kind of forest animal they were pretending to be.

Forest Art--Preparation

This station can go anywhere along the trail. Place a large bottle or jug of water at the station. Prepare enough Art Kits so each student in a group will be able to have their own. Label each kit by a color, i.e. The Red Kit, The Blue Kit, etc.
ART KIT:
Watercolor paint tray, paintbrush, small pan or jar for water, Art Kit Instructions

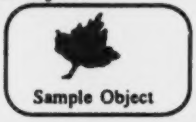
Skills: observing, drawing, painting
Subjects: Art
Materials: jug of water, several Art Kits

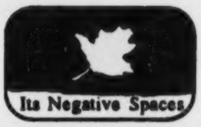
Forest Art--Instructions

1. Arrange yourselves in a circle or line, so it will be easy to tell whose turn is next. The first person in line should point out some part of the forest that is red. Each person in line must then point out something different that also contains the color red. Look carefully, anyone who can't see anything new that contains the color is are out of the game until the next round. The last player to point out something red will get the Red Art Kit.
2. Everybody joins in again for the next round.Play again for the colors yellow, blue, green, black, and brown. The winner of each round gets the Art Kit of that color.

ART KIT INSTRUCTIONS

1. The color of this kit is "your color." Find something from the forest that contains your color.
2. Turn to the next page in your forest notebook and draw a picture of the negative spaces around this object:


Sample Object


Its Negative Spaces

You may be surprised to find that once you have drawn the negative spaces, you will have drawn the item!
3. Now put some water from the jug in your pan or jar. Use the paintbrush and watercolors to mix a paint that matches as closely as possible the shade and tint of your color that occurs in the natural object. Then paint your color wherever it should go in your negative space drawing of the forest object. When everyone in your group is done, move on to the next station.

CLASSROOM FOLLOW-UP: Set up a display of student artwork. Discuss the difficulty of matching nature's colors. Help students improve their color mixing skills.

Listening Station—Preparation

Select a spot along your trail that is farthest away from distracting noises such as a highway, parking lot, or playground. Sites that are near open water, contain standing dead or dying trees, or have a variety of vegetation layers (tree canopy, tall and low shrubs, and ground cover plants) will be good choices for this station as they are likely to attract birds. Cut the Listening Station Instruction Card along the line, and place both sections at this station. Before taking students out on the trail, familiarize them with the calls and songs of common local birds by using the Pre-Fieldwork Activity 1 suggested on page---.

Skills: listening, observation, identification
Subjects: Science, Music
Materials: none

Listening Station—Instructions

1. Write the heading "Forest Sounds" at the top of the next page in your field notebook.
2. READ INSTRUCTIONS 3-5 BEFORE DOING ANYTHING ELSE.
3. Move to a spot where you can still be seen from this station, but that is off the trail, and a little bit out of view. You may want to choose a spot under a tree, or a nice rock or fallen tree to sit on. YOU MUST SIT AT LEAST 10 FEET AWAY FROM ANYONE ELSE. Sit so that you face away from other students. Be very quiet, close your eyes, and listen carefully to the sounds of the forest.
4. Listen to the trees, shrubs, snow, ground, birds, and animals for a few minutes. Then, slowly open your eyes. If you were very quiet, a forest animal may just be poking its nose out at you. Keep listening and quietly make a map of the sounds around you in your notebook. Label each sound and place it on your map.
5. The next group will be along soon after you finish your map. You'll hear them coming! Just think if you were an animal and heard all that noise. Would you stay out where you could be seen? Try to be so quiet that they don't notice you. If they don't see you, you can jump out and say "I'm a bear and you just got eaten!" when they start reading these instructions.

READ STEP 6 ONLY AFTER YOU HAVE FINISHED STEPS 1-5.

6. As the next group moves to their sitting spots, compare the sounds you heard with other group members. Did you all hear the same things? Move off to the next station. Try to be very quiet so the next group will be able to hear the forest sounds, and so you don't scare any animals that are ahead of you on the trail. Now that you know about forest sounds and being quiet, maybe you'll get a chance to hear or see some forest wildlife. (Its a good idea to be somewhat noisy if there are likely to be bears in the area--they will usually move away if warned of your approach.)

Nosing About—Preparation

Place this station anywhere along the trail that includes the items in the smelling kit. Just prior to the field trip, do Pre-Fieldwork Activity 2 as described on page 3. Prepare enough Forest Smells kits as described below so each pair of students can have one.

FOREST SMELLS KIT:
1) a bandana for use as a blindfold; 2) 5 plastic bags with the following clearly labeled forest items:
1. rotting leaf litter or humus, 2. a piece of rotten wood, 3. fresh twigs from a shrub or hardwood tree, 4. a conifer branch or cone, 5. a shelf fungus (Or other smelly items.) 3) a copy of Nosing About Instructions -- Part 2

Skills: using senses, recall, working together
Subjects: Science, Social Studies
Materials: see Forest Smells Kit described above

Nosing About---Instructions

PART 1.

1. Count off your group (1, 2, 3,...). If you are an odd number, pair off with an even numbered student. (1,3, 5, 7 are odd numbers, 2, 4, 6, 8 are even)
2. You and your partner take one Forest Smells Kit.

PART 2.

1. The odd-numbered partner should put the blindfold on and start testing their sniffing abilities, while the even-numbered partner should read instructions 2 and 3.
2. Look at the contents of this kit. Each enclosed bag contains an item from this area. Look for each item in the surrounding area, then carefully lead your partner to it. Tell them what each item is, then have them smell it. Be very careful leading your partner around because they can't see. You must tell them when to step over a log or rock, and when to bend down.
3. After you have let your partner smell each item in the wild, have them sit down. Now, have them smell each bagged item (mix up the order) and see if they can identify them by remembering the smells. How many do they correctly identify?

READ ON ONLY AFTER YOU DO STEPS 2 & 3

4. Trade places. The even-numbered partner should put the blindfold on now. The odd-numbered partner should have the blindfolded person smell each bagged item. How many can they recognize by smell alone? Did they use their sense of smell when they could rely on sight? As you move down the trail, sniff the wind and the trees. Most forest mammals rely more on smell than on sight. They can smell other animals, food, and you. If you use your sense of smell carefully, you can learn to detect some of them by smell too. River otters have a very distinctive odor. You can sometimes avoid trouble with bears by learning to recognize the smell of a dead animal--bears are attracted to this smell, and they will guard a carcass.

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Tree Identification—Preparation

This station should be placed at a spot along the trail where there are examples of the different kinds of trees in the area. The station should include the items listed in the Materials section below.

Skills: observing, measuring, identifying, drawing
Subjects: Science, Math, Art
Materials: Tree Identification Chart, small ruler, hand lens, brown, black and green crayons; Class Follow-up: Forest Wildlife Cards on trees, and/or a guide to tree identification (see reference list).

Tree Identification—Instructions

1. Look at the Tree Identification Chart. It shows some of the different shapes and characteristics of Alaskan trees and their parts. Notice the different types of tree shapes, branching arrangements, leaf shapes and margins, and bark patterns.

2. Turn your notebook so that the long side of the page is facing you. Write the heading "Alaskan Trees" along what is now the top edge of the next clean page. Write these headings across the page to form columns as shown below:

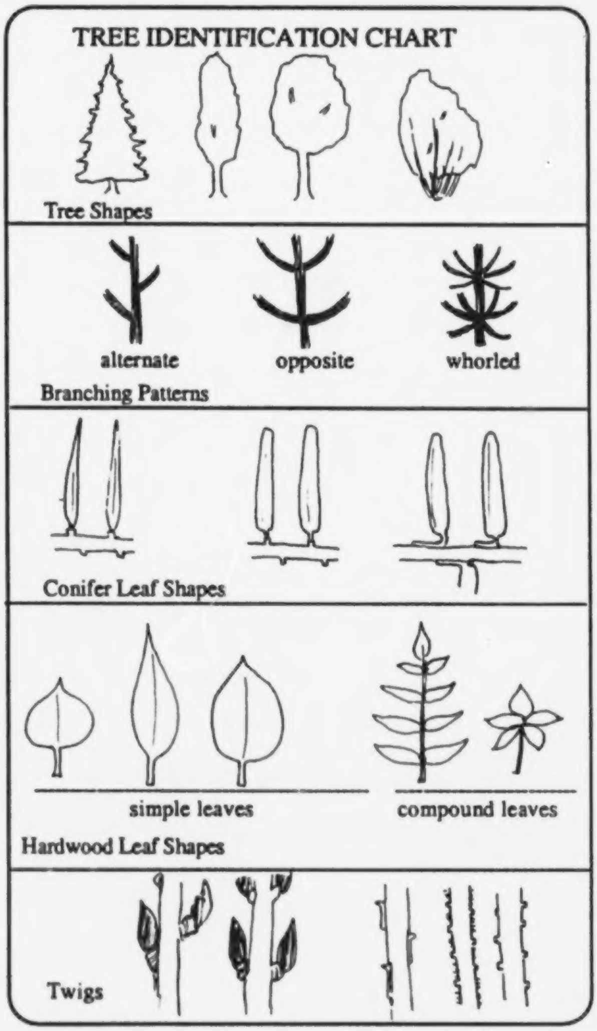
Tree Shape	Branching	Leaves	Twig	Bark	Species

2. Look at the nearest tree and fill in your Alaskan Trees chart with drawings of the shape and branching of this tree. Make a crayon rubbing of the bark by holding your paper against the bark and rubbing a crayon over the top of the paper. Make a rubbing of the leaf by placing the leaf under the paper, then rubbing the crayon over it.

3. Measure the length of a leaf using a ruler and write this measurement below your crayon rubbing.

4. Look at a twig at the end of a tree branch. Examine it with the hand lens. Is it covered by small hairs, or is it smooth? Write hairy or smooth under your drawing of the twig.

5. Draw a line under these drawings, then find a different kind of tree and repeat Steps 2-4. Complete your chart so it includes information on all the different kinds of trees in this area. Use a second page if you need it.



CLASSROOM FOLLOW-UP: Use your field notes on Alaskan Trees, along with the Forest Wildlife Cards on Alaska trees, or a guide to Alaska trees to identify the tree species you saw in the forest. Write the species name in the column "Tree Species." Below its name, write down the one trait that will help you separate it from similar trees next time you see it.

Tree Trunks—Preparation

This station should be placed at a location where one or more trees has been cut down fairly recently so that the annual rings are still visible; OR place a tree trunk slice that was cut elsewhere at this station; OR if you have access to an increment borer, you could take a core from a living tree. (Contact local foresters with the U.S. Forest Service or State Division of Forestry to see about using one of these tools.)

Skills: observing, measuring, counting, estimating
Subjects: Science, Math
Materials: yard or meter stick, length of string

Tree Trunks—Instructions

Write the heading "Tree Trunks" across the top of the next page in your notebook. Record your answers to the questions below, and make any calculations on this page.

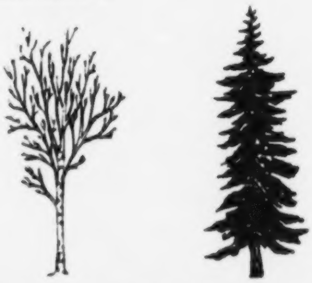
1. Look at this section of tree trunk and try to identify the various layers--pith (very center) the heartwood (dark center), the sapwood or xylem, the cambium, the phloem, and the outermost bark. Measure each part and record its thickness (inner to outer edge).

2. Can you see the annual rings? Count the very center as 1, then count the number of dark rings to find out how old the tree was when it was cut down. Record your answer as "Tree Age = ——."

3. Did you notice that the rings are various distances apart? Find the two that seem closest together.

These indicate a year when the tree did not grow very much. It may have been a very dry year, or a year when the tree lost many of its leaves to insects or fire. How many years ago did this occur?

Find 2 rings that are spaced furthest apart. These indicate a year that the tree grew well. This was probably a year with plenty of moisture, few insects, and warm temperatures. How many years ago did this occur?



4. As you know, even if this tree were alive and standing, only the cambium layer would be growing. The pith, heartwood, sapwood, phloem, and bark do not grow. If the bark is dead and doesn't grow, how does the tree trunk manage to get larger as the tree gets older?

5. You will later be able to estimate the ages of other trees in this area by comparing their trunk measurements to the measurement of this tree for which you know the age. First measure the circumference of this tree by measuring the length of string that is needed to go all around the trunk at the height of a person's shoulders. Record this measurement next to the tree's age. Then measure and record the circumferences of 10 other trees in this area. You'll want to select both large and small trees.

CLASSROOM FOLLOW-UP: Estimate the age of each unknown tree at the Tree Trunk Station by using the following formula:

$$\text{Age of Unknown Tree} = \frac{\text{Age of Known Tree} \times \text{Circumference of Unknown Tree}}{\text{Circumference of Known Tree}}$$

Did the ages of the trees at the place you studied vary? By how many years? What factors might cause this method of estimating tree ages to give incorrect estimates?

Inaccurate estimates may result because different trees may have grown at different rates. Other trees may have lived through more bad or good years than the sample tree, and thus have a relatively smaller or larger trunk. Comparisons of different tree species would also cause errors; different species grow at different rates.

Dead Trees—Preparation

This station should be placed along the trail where there is a standing dead tree and a fallen dead tree, preferably one that fell several years ago and pulled up its roots when it fell. It should also be placed after the bird and mammal signs stations so that students have learned to look for these.

Skills: observing, inferring, predicting
Subjects: Science, Social Studies
Materials: hand lens

Dead Trees—Instructions

1. Turn to the next page of your field notebook and label it "Dead Trees". Record your notes and answers to the questions below on this page.
2. Standing dead trees are called snags. Look carefully at the snag at this site and see if you can find evidence that living things are using it, or have used it in the past. (Some hints of things to look for are listed below.) List in your notebook, under the heading, "Live on a Snag," those organisms of which you find evidence.
3. Look at the fallen dead tree at this site and try to figure out what kinds of living things are using or have used it. (Some hints of things to look for are listed below.) List the kinds of living things you find evidence of in your notebook under the heading "Life on a Fallen Tree."
4. Much of the sunlight energy which a tree stores through photosynthesis is stored in the wood of the tree trunk. Is this energy lost, or used by other living things after the tree dies?
5. Many of the minerals that a tree takes up from the soil are stored in its trunk. Look at the fallen dead trees in this area carefully. What evidence do you see that suggests the minerals in tree trunks are returned to the soil?
6. Nurses are people who help other people. Why do you think fallen dead trees are often called "nurse trees"?

SIGNS OF LIFE ON A DEAD TREE

MICROSCOPIC ORGANISMS: Rotten and crumbly wood or slimey coating on any part of the tree.

FUNGI: Mushrooms, shelf fungi, fuzz or furry coating on any part of the tree.

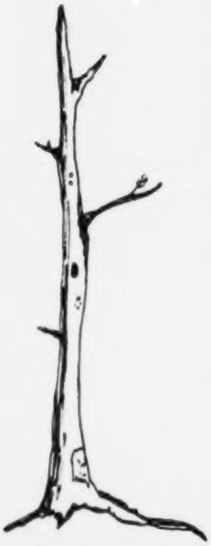
PLANTS: Are any small plants growing in the cracks or crevices?

ANIMALS:

Invertebrates--Look carefully at any crumbly wood, in the cracks and crevices of the wood, and near any reddish brown sawdust. Carefully remove a few pieces of loose bark or crumbly wood to see if anything is underneath these. Look carefully using a hand lens so you won't miss tiny invertebrates. Be sure to replace the wood pieces carefully so that any animals that live there will still have a home.

Mammals: Look for hair, droppings, scratch marks on the tree, and in hollow places where an animal might hide.

Birds: Look for drill holes in the bark or a round hole into the trunk. These were likely made by woodpeckers. These birds feed on beetles that eat wood. Look for feathers, whitish droppings, or raptor pellets on or beneath the tree.



CLASSROOM FOLLOW-UP: Use the information you collected at the Dead Trees station to think of three forest food chains that include dead trees. How might the removal of all dead trees affect a forest? (Think carefully about which living things use dead trees, and about the cycle of minerals.)

Insect Signs Station Preparation

Place the Insect Signs Instruction Card, the Insect Signs Chart, and a hand lens at a spot along your trail that includes a variety of live plants (trees, shrubs, and groundcover) and dead leaves. Look for a spot that includes galls on plants, or a tree with bark engravings or reddish brown sawdust at its base. Record the number of insect signs you find at the spot and their location for later comparison with student notes. You may want to use this card at different sites, if you find different kinds of insect sign in different areas.

Skills: observation, identification
Subjects: Science
Materials: Insect Signs Chart (see page 10), hand lens

Insect Signs—Instructions

Insects are some of the most important consumers in forest ecosystems. The Insect Sign Chart shows some of the evidence some insects leave behind. How many of these signs can you find in this area?

1. Write the heading "Insect Signs" at the top of the next page in your field notebook. Record the number of different types of insect signs you find in this area.
2. List each type of insect that you find evidence of and draw a sketch to remind you what its sign looked like. (Your sketch or its label should indicate the leaf or type of wood you found the sign on.)
3. Write down where in the food chain the insects of which you found signs probably fit.
4. If you find any other signs of insects elsewhere along the trail, make notes of your findings on this page.

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Mammal Signs Station-Preparation

Place the Mammal Signs Instruction Card and the Mammal Signs Chart at a spot along your trail where you have found evidence of two or more mammals. Good spots to look are near open water, sites with less snow, and a variety of types of shelter. You may want to use this card twice if you find two areas with different types of mammal sign. Record the number of signs you find on the instruction card as an incentive for students, and the kinds of signs present for later comparison with student notes.

If desired, you can have students make a plaster track print at this same station. See the Track Casting Station Card (p. 18).

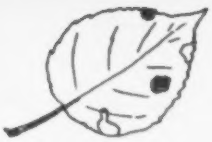
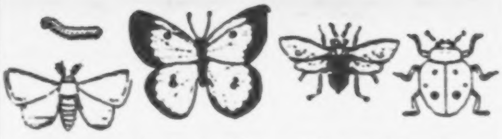
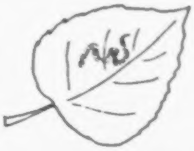
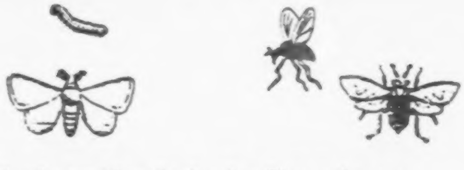
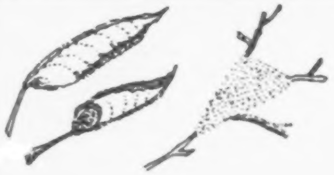
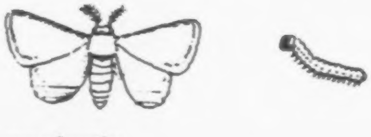
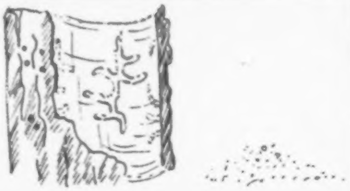
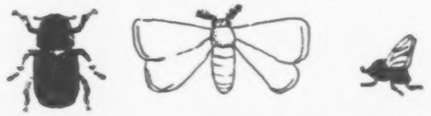
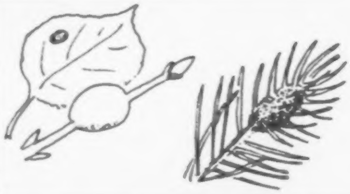
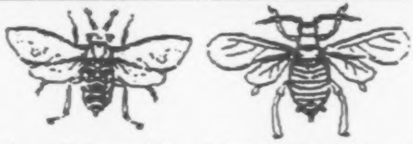
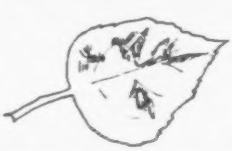
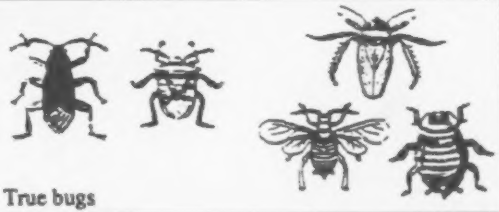
Skills: observing, identifying, inferring, comparing, descriptive writing
Subjects: Science, Language Arts
Materials: Forest Mammal Signs Chart (see page 11-12) or a Guide to Animal Tracks (see reference list)

Mammal Signs—Instructions

The attached Mammal Sign Chart shows some evidence of mammals you might find in this forest. There are signs of at least ____ kinds of mammals in this area alone. Can you find these signs and identify them?

1. Write FOREST MAMMALS at the top of the next page in your field notebook. Record the number of different types of mammals of which you find evidence in this area.
2. List the types of mammals of which you found evidence along the left side of your paper.
3. Write down what you think they eat based on the sign you found.
4. Write a short description of their signs next to each animal's name. Try to compare the sign to something familiar, make a rhyme, or a humorous statement in order to help you remember which sign is evidence of which animal. (For example: Deer droppings look like big chocolate chips. Hare browsing makes a willow look like a clipped hedge.)
5. If you find signs of other mammals along the trail, make notes of your findings on this page.

Forest Insect Signs Chart

Feeding Method	Signs	Examples of Insects That Leave These Signs
Leaf-chewing Insects		 Larvae of moths, butterflies, sawflies, and beetles
Leaf-mining Insects		 Tiny larvae of moths, beetles, flies, and wasps
Leaf-rollers and Tent Caterpillars		 Larvae of moths
Cambium-eating Insects		 Larvae of bark beetles, a few moths, and some flies
Gall-making Insects		 Wasps, flies, sawflies, gall-making aphids, and spruce aphids.
Sap-sucking Insects	Yellowed or discolored leaves 	 True bugs

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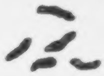
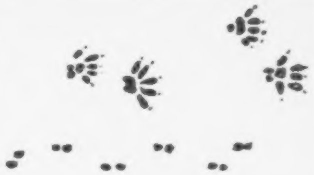
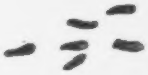
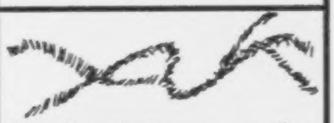
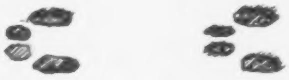
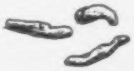
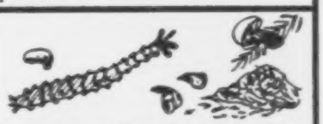
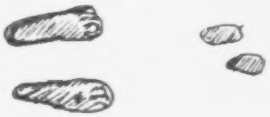
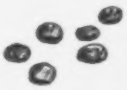
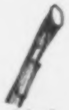
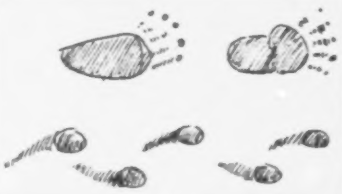
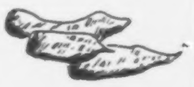
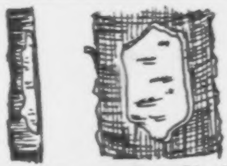
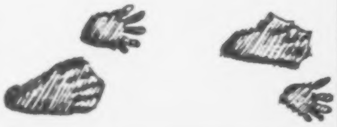
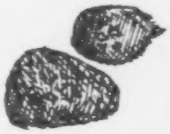
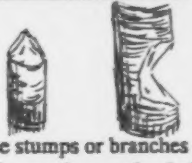
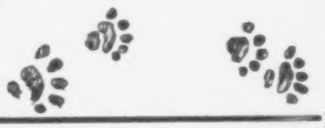
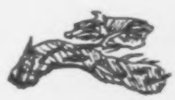
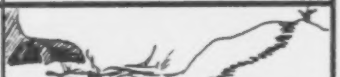
Forest Mammals Sign Chart

Animal	Tracks	Droppings	Other Signs
Shrew			
Vole or Mouse			 Tunnels under the snow, or, after the snow melts, small piles of grasses lying in tunnel-like patterns.
Squirrel			 Large piles of cones, cone scales, and cone cobs, called middens. Also, mushrooms hanging in trees.
Snowshoe Hare			 Willows, birch, rose, aspen, or other plants with stems neatly clipped off.
Porcupine			 Large strips or patches of bark missing from a tree trunk.
Beaver			 Tree stumps or branches with gnawing marks; lodges or dams of sticks and branches.
River Otter			 Strong odor; trampled grasses and plants, dens under tree roots, and sledding trails on small slopes.

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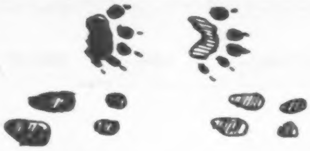
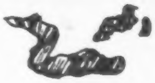
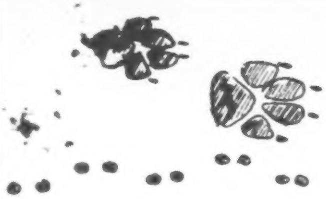
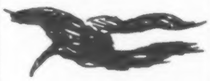
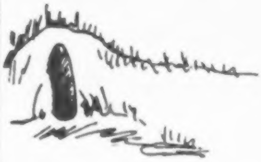
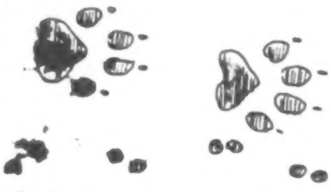
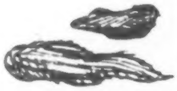
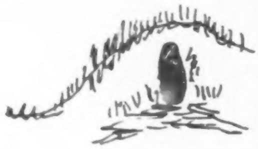
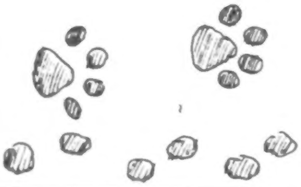
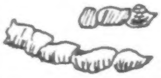
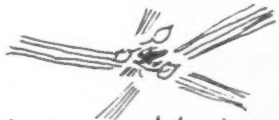
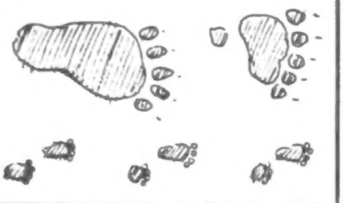
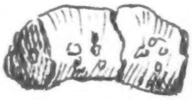
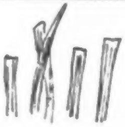
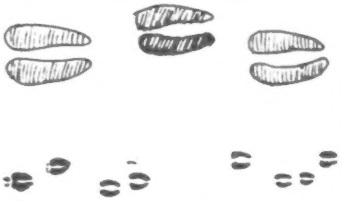
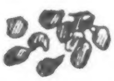
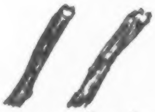
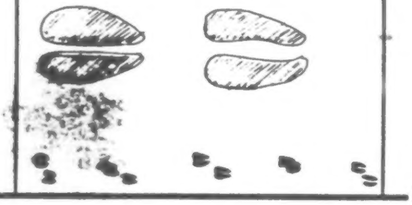
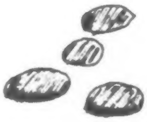
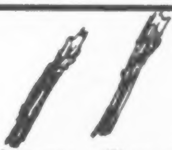
Animal	Tracks	Droppings	Other Signs
Marten			
Fox or Coyote			 Dens
Wolf			 Dens
Lynx			 Scrapings around droppings.
Bear			 Grasses and sedges that have been grazed or clipped off. Skunk cabbage that is torn or dug up.
Deer			 Huckleberry or other shrubs with stems that appear to have been chewed off.
Moose			 Birch, aspen, willow, or other plants with stems browsed off (not neatly clipped off).

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Bird Signs Station—Preparation

Place the Bird Signs Instruction Card and the Bird Signs Card (see page 14) at a spot along your trail where you can see evidence of 1, 2, or more birds. You may want to use this card twice if you find areas with different signs. (It isn't inexcusable to salt the area you choose with a feather or raptor casting, though it will be more exciting if you can find these signs along your trail.) Record the number and kinds of signs you find at the spot for later comparison with student observations or notes. Fill in the number on the instruction card.

Skills: observing, identifying, inferring
Subjects: Science
Materials: Forest Bird Signs Chart, or A Guide to Animal Tracks (see reference list) and a field guide to birds.

Bird Signs—Instructions

You've probably heard of mammal tracks, but did you know birds leave signs too? Open your eyes and look carefully, you may be able to find the ____ kinds of sign that are in this area.

1. Write FOREST BIRDS at the top of your next page.
2. Record the number of kinds of birds for which you found sign at this spot, then list them by name along the left side of the page.
3. Listen and look carefully, these birds may still be nearby. Have one person in your group repeatedly make a shhh, shhh, shhh sound. Sometimes birds will move or call when they hear this sound.
4. If you found sign of grouse or woodpeckers, look these groups up in the field guide to birds. Based on the season and the habitat you are in, can you figure out which kind of grouse or woodpeckers might be in this area? List the species you think are most likely those that made the signs.
5. If you find signs of other birds along the trail, make notes of your findings on this page.

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Fungi Station—Preparation

Look for a site that has dead leaves and dead trees to place the Fungi Station Card. Put copies of the fungi cards from the Forest Wildlife Cards set, a hand lens, and several small plastic bags with the instruction card. Have students conduct the follow-up investigation upon returning to class. NOTE: If the growth in their sample is fuzzy, it is probably a fungus (mold). If it is slimy, it is probably a yeast (a type of fungi) or bacterial growth (a type of moneran). Students should recognize that the organisms that grow are unlikely to be producers since they did not receive any light, and light is needed for photosynthesis.

Skills: observation, identification
Subjects: Science, Art
Materials: Fungi cards from the Forest Wildlife Card set, plastic bags, hand lens; For Follow-up: plastic wrap, several small dishes or a disposable muffin tin filled with an agar mixture (made by combining 2 cups boiling water, 2 teaspoons sugar, 2 teaspoons beef or chicken bouillon powder, and 4 teaspoons of gelatin.) Fill cups with liquid and allow to set.

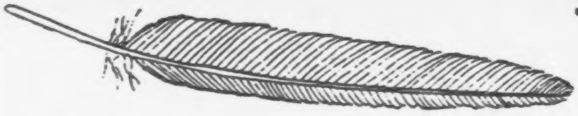
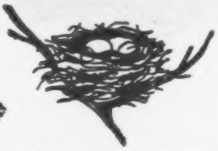
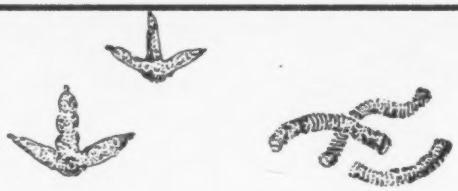
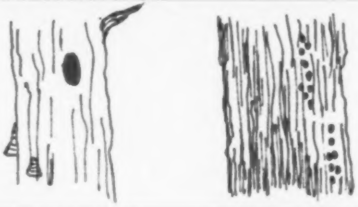
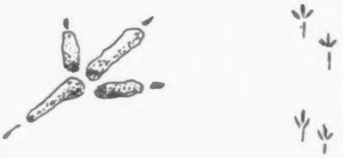
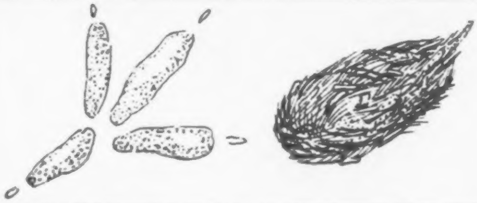
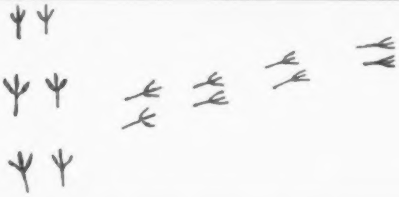
Fungi Station---Instructions

1. Write Forest Fungi at the top of the next page in your field notebook.
2. Look at the pictures of fungi on the cards, then look around this area carefully and try to find as many kinds of fungi as you can. Draw pictures of those you see in your notebook.
3. Can you see any evidence that fungi are detritivores? Write down any evidence you notice.
4. Probably most of the fungi you noticed at first were large fruiting bodies of mushrooms or shelf fungi. These fungi, like others, are actually made up of tiny or microscopic hair-like parts called hyphae. Look closely at the dead leaves and decayed wood in this area with a hand lens. Can you see any hair-like fuzz or strands?
5. Based on what you know about fungi, select 2 items from this area that you think might have some kind of fungi growing in them. Place a sample of each in a plastic bag, label the bags Fungi Sample 1 and Sample 2. Record in your notebook what each sample is. Take these samples back to the classroom with you.

CLASSROOM FOLLOW-UP:

Place your fungi samples in separate dishes filled with agar, a medium that contains energy and minerals. Cover these with plastic wrap and place them in a warm, dark place. Wait a few days, then see if anything has grown. Do you predict that anything will grow? If something does grow, is it more likely to be a producer or a consumer?

Forest Birds Sign Chart

Bird	Signs
Signs Left by Many Birds	 Feathers  Stick or Grass Nests
Grouse	 Grouse make 3-toed tracks on solid snow or wet soil, but in deep soft snow they make a trail that looks like a ditch in the snow. Their droppings seem dry and are shaped like worms.
Woodpeckers	 Listen for tapping or drumming sounds. Look on live and dead trees for small or large holes that look like something drilled into the bark of the tree. Also look for flakes of bark around the base of trees.
Raven	 Droppings and tracks around a dead animal. Hoarse croaking sounds.
Hawks and Owls	 Hawks and owls regurgitate pellets of fur, feathers, and other indigestible bits of the prey. These pellets are cleaned of all meat, so they smell and feel clean.
Songbirds	 Listen for twittering, chirping, or other calls and songs.

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Forests and the Air—Preparation

To investigate the inter-relationships between forests and the non-living environment, students will need to take measurements at a forested and a non-forested site, so they can see the differences and try to infer the causes of these differences. Place the Instructions 1 Card at whichever site comes first along the trail, and Card 2 at the second. Prepare the 2 air studies sites at least 1 day in advance. At each site, place a plastic bag around a leafy branch of a conifer, a hardwood, and a dead stick. Tightly seal each bag around the branch with a rubberband. (This experiment will only work well if the ground is thawed.) Tie an index card to a branch of a tree or shrub, then spread petroleum jelly over it. This will trap dust in the air.

Skills: observing, measuring, inferring, predicting
Subjects: Science, Social Studies
Materials: small plastic bags, rubber bands, petroleum jelly, index cards, pinwheel or wind gauge

Forests & Air—Instructions 1

Write the heading "Forests and the Air" across the top of the next page in your notebook. Draw a line down the center of the page, and put a heading that describes this site at the top of the left side. Record your answers to the questions below on the left side of the page below the heading.

1. Hold the pinwheel or wind gauge up over your head and slowly turn around. If there is any wind, the gauge or wheel will turn. Record whether you observe any wind at this site and whether the wind caused the gauge or pinwheel to turn 1) not at all, 2) very slowly, 3) slowly, 4) fairly quickly, or 5) very quickly.
2. The card tied on the tree is a trap for dust in the air. Use a hand lens to look at it closely. Record the amount of dust it has trapped: 1) none, 2) a few specks, 3) 10-20 specks, 4) 20-50 specks, 5) over 50 specks
3. Look at a branch of a conifer tree using a hand lens. Record the number of dust specks on it using the same scale as above.
4. Look at the leaf of a hardwood for dust specks, if the hardwoods are leafed out. Record the number of dust specks on the leaf using the same scale.
5. The plastic bags that are tied around the branches of a conifer, a hardwood, and a dead branch were all dry when tied on to these trees. Record which, if any, bags now contain water. How do you think this water got into the bag?

Forests & Air—Instructions 2

Turn to the page in your notebook labeled "Forests and the Air." Put a heading that describes this site at the top of the right side. Record your answers to the questions below on the right side of the page below the heading.

1. Hold the pinwheel or wind gauge up over your head and slowly turn around. If there is any wind, the gauge or wheel will turn. Record whether you observe any wind at this site and whether the wind caused the gauge or pinwheel to turn 1) not at all, 2) very slowly, 3) slowly, 4) fairly quickly, or 5) very quickly
2. The card tied on the tree is a trap for dust in the air. Use a hand lens to look at it closely. Record the amount of dust it has trapped: 1) none, 2) a few specks, 3) 10-20 specks, 4) 20-50 specks, 5) over 50 specks.
3. Look at a branch of a conifer tree using a hand lens. Record the number of dust specks on it using the same scale as above.
4. Look at the leaf of a hardwood for dust specks, if the hardwoods are leafed out. Record the number of dust specks on the leaf using the same scale.
5. The plastic bags that are tied around the branches of a conifer, a hardwood, and a dead branch were all dry when tied on to these trees. Record which, if any, bags now contain water. How do you think this water got into the bag?

CLASSROOM FOLLOW-UP: Compare the two Forests and Air sites. 1. Did one site have a stronger wind than the other? Which one? Why do you think there was a difference? If you did not observe a difference, do you think you would have found a difference on a more windy day? Which do you hypothesize (guess) would be more windy, based on your observations of the plants at each site? Why do you hypothesize this? 2. Which site had the least dust in the air? Why do you think this difference occurred? Did the leaves of conifers or hardwoods trap dust? How might this affect the air? 3) Based on the bags that you found water in, did you conclude that the plants were somehow putting moisture into the air? If you did, your answer is correct. A tree may pump 80 gallons of water into the air in a single day. Which of the two sites do you think is most likely to have moister air? 4) Based on your observations, name three ways that forests affect the air. Name one other way that forests affect the air. (Hint: remember photosynthesis.)

Students should find less wind and less dust in the forested site, and predict that the forested site would have the most moisture in the air. Students should conclude that forests break the wind, remove dust from the air, and add moisture. They should remember that trees and other plants, and therefore forests, add oxygen and remove carbon dioxide from the air.

Forests and Sunlight----Preparation

To investigate the inter-relationships between forests and the non-living environment, students will need to take measurements at a forested and a non-forested site, or at a heavily forested and open forest sites, so they can see the differences, and try to infer the causes of these differences. Place the Part 1 card at whichever site comes first along the trail, and card 2 at the second. Students will need the same equipment at each site.

Skills: observing, measuring, drawing
Subjects: Science
Materials: thermometer, colored pencils

Forests and Sunlight Instructions 1

1. Turn to the next page of your field notebook and write the heading "Forests and Sunlight". Draw a line down the center of the page. Write down a heading that describes this site on the left side of the paper.

2. If you look up, the main plants you'll see are trees, if any occur at this site. These form the overstory, or canopy layer of plants. If you look straight ahead, you may see another layer of plants, the understory or shrub layer. If you look down, you'll see a ground cover layer of plants. Different sites usually have different numbers and kinds of plant layers. Some sites have only one of these layers. Other areas may have more layers--perhaps a tall tree, small tree, tall shrub, low shrub, and groundcover layer will be present.

Look around you and draw a picture on the left side of your page that shows the different layers of plants in this area. Use a different colored pencil to draw each layer. The number of lines you draw for each layer should show how many plant stems are in that layer. Draw in many lines to show that there are many plant stems. If there are large spaces between the plants in any layer, then draw just a few lines.

3. Look overhead at the number of leaves and branches. These block sunlight and prevent it from reaching the ground. How much sunlight do you think reaches the shrub layer at this spot--1) nearly all sunlight, 2) some, but not all sunlight, or 3) very little sunlight? How much reaches the ground? Record your answers in compelete sentences below your drawing.

4. Use the thermometer to measure the air temperature. Record this in your notebook below your drawing of this site.

Forests and Sunlight Instructions 2

1. Turn to the "Forests and Sunlight" page that you set up earlier. Write a heading that describes this site on the right side of the paper.

2. Look around you and draw a picture on the right side of your page that shows the different layers of plants in this area. Use a different colored pencil to draw each layer. The number of lines you draw for each layer should show how many plant stems are in that layer. Draw in many lines to show that there are many plant stems. If there are large spaces between the plants in any layer, then draw just a few lines.

3. Look overhead at the number of leaves and branches. These block sunlight and prevent it from reaching the ground. How much sunlight do you think reaches the shrub layer at this spot--1) nearly all sunlight, 2) some, but not all sunlight, or 3) very little sunlight? How much reaches the groundcover layer. Record your answers in complete sentences below your drawing of the plant layers at this site.

4. Use the thermometer to measure the air temperature. Record this in your notebook below your drawing of this site.

CLASSROOM FOLLOW-UP: Compare the two Forests and Sunlight sites. Which site had the most plants in the shrub and groundcover layers? Was this the site at which more or less sunlight reached the ground? Why would the amount of sunlight reaching the ground affect the number of plants growing there? In which site was the air warmer? How does the air temperature relate to the amount of sunlight reaching the ground? Which site, the sunny one or shaded one, would provide more food for animals that eat groundcover plants? Which site would provide more food for animals that eat shrubs? Would you expect to find more shrub and ground-cover plant eaters in a dense forest, or an open forest?

Students should conclude that the more sunlight reaches the shrub and groundcover layers, the more plants will grow, because plants need sunlight for photosynthesis. Sunnier sites will have more low-growing plants and thus more food for those animals that feed on those plants.

Forests and Soil—Preparation

Students will compare the soil at a forested and a non-forested site. Place the Part 1 card at whichever site comes first along the trail, and card 2 at the second. Students will need the same equipment (see Materials list below) at each site. Prepare each site by digging a soil pit in the ground, or by using a soil core sampler to extract a soil sample. (Contact foresters or soil scientists to see about using one of these tools.)

Skills: observing, measuring, drawing
Subjects: Science
Materials: thermometer, colored pencils, ruler or yard/meter stick, plastic bag, labels, trowel; For Classroom Follow-up: scale for measuring weights, small paper or aluminum cups, a sunny, dry spot or an oven, a light, perforated or screened tray, tray, hand lens or microscope

Forests and Soil—Instructions 1

1. Turn to the next page of your field notebook and write the heading "Forests and Soil." Draw a line down the center of the page. Write a heading that describes this site on the left side of the paper. Record your answers below this heading.

2. Look carefully at the soil pit or core sample. Can you see any different layers in the soil? Draw a picture of the different layers in your notebook using the colored pencils to show the differences in color. Measure the thickness of each layer and record it next to that layer in your drawing.

3. Look carefully at each layer of soil using the hand lens and record what you think the layer is made of next to your drawing.

4. Collect a trowel full of soil and place it in a plastic bag. Seal this bag tightly and label it Soil Sample 1.

5. Collect another sample of soil. Be sure to collect the litter and humus layers. Place the sample in a separate plastic bag. Seal the bag and label it Soil Sample 2.

Forests and Soil—Instructions 2

1. Turn to the page of your field notebook that has the heading "Forests and Soil." Write a heading that describes this site on the right side of the paper. Record your answers to the questions below underneath this heading.

2. Look carefully at the soil pit or core sample. Can you see any different layers in the soil? Draw a picture of the different layers in your notebook using the colored pencils to show the differences in color. Measure the thickness of each layer and record it next to that layer in your drawing.

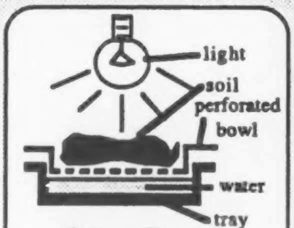
3. Look carefully at each layer of soil using the hand lens and record what you think the layer is made of next to your drawing.

4. Collect a trowel full of soil from a nearby spot and place it in a plastic bag. Then seal the bag and label it Soil Sample 3.

5. Collect another sample of soil. Be sure to collect the litter and humus layers. Place the sample in a separate plastic bag. Seal the bag and label it Soil Sample 4.

CLASSROOM FOLLOW-UP:

1. Compare your drawings of the two Forests and Soil sites. Which site had the thickest layer of leaf litter and humus (the top two layers of soil). Why do you think this difference occurred?
2. Measure out equal weight samples from soil samples 1 and 3, and place them in separate cups. Which smells more pungent? Place the samples in the sunlight or in a low-heat oven to dry them out. Then, reweigh them. Subtract the second weight of each bag from its first weight. This will tell you how much mositure was in each sample. Which sample contained more moisture. Why might this have been?
3. Use your soil samples 2 and 4 to set up 2 Tullgren trays as shown in the diagram. Check the tray every 24 hours. At each check, remove and examine the contents of each tray using a hand lens or binocular scope. Which sample contained the most number and variety of soil invertebrates? Did the two samples contain mainly the same kinds of invertebrates or different ones? How do you explain the differences? t



Tullgren Tray

Students should find that the leaf litter and humus layer of soil is deeper in the forested area, and that the soil is darker. They should also find that the forest soil sample smelled more pungent, contained more moisture and a greater number and variety of invertebrates. These differences are inter-related. An acre of forests may deposit over a ton of leaves on the forest floor each year, far more than the leaf drop in other habitats. The organic layer of soil is formed through decay of the leaf litter, and is mixed with the next soil layer by invertebrates. Organic material smells pungent, holds water, and provides food for invertebrates.

Track Casting—Preparation

Place this card and the materials listed below at some site along the trail where tracks of mammals or birds are easy to find, and that students will be able to come back to after 20 or more minutes. (You may want to set up a sample casting.)

Skills: observing, following instructions
Subjects: Science, Art
Materials: 1 jar of plaster of paris, 1 jar of water, 1 empty jar, a pail of wash water, 1-inch wide lightweight cardboard band, toothbrush, forceps, an animal track; For the Classroom Follow-up: playdough (homemade from flour, water, salt, oil, cream of tartar, and food coloring), a flat box, rolling pin; felt tip pens and cards.

Track Casting—Instructions

1. Be careful not to step on the animal tracks in this area so that other students will beable to see and use them. Select the track of one animal from this area. (Try to pick the track of a kind of animal no one else has already chosen.)
2. Carefully remove sticks and leaves from the animal track with forceps. Press a band of cardboard in the snow or mud around the track.
3. Using the empty jar, mix a half cup of plaster powder with enough water to make a thick batter. If the track is in snow, mix snow with the water before you mix up the batter. This cold batter will be less likely to melt the snow and ruin your track. Pour the batter inside the cardboard band over your track.
4. It will take about 20 minutes or longer for your track casting to dry. Wash out the jar you mixed up the plaster in, so the next group can use it. Then, move on to the next station and plan to stop by here later to pick up your track casting. Carefully clean off any dirt using the toothbrush, then take the track casting back to class.

CLASSROOM FOLLOW-UP:
Make a track display! Combine 2 cups flour, 1 cup salt, 2 cups water, 3 teaspoons cream of tartar, 2 tablespoons cooking oil, and a few drops of food coloring in saucepan; cook until stiff to make playdough. Have students role out a large 3/4 inch thick pancake of dough. Press each track print into the dough to make replicas of the tracks found in the forest. Have students make labels for their replica tracks and a title sign for their display (such as "Forest Tracks"). Put the display up for other students in the school to see.

Detritivores—Preparation

This station can be set up anywhere in the forest. One day or more before students use the trail, tie two small net bags filled with 1) rotten meat and 2) rotten fruit at nearby spots on the forest floor.

Skills: observing, inferring, predicting
Subjects: Science
Materials: small net bags, rotten meat, rotten fruit, string, labels, forceps, magnifying glass

Detritivores—Instructions

1. Turn to the next page in your field notebook and label the page "Forest Detritivores". Record your answers to the questions below on this page.
2. Look carefully at the small net bags that are tied to the forest floor in this area. Divide your page in half with a line and label one side as Bag 1 and the other side as Bag 2. Below the label, record what that bag contains (either rotten meat or rotten fruit).
3. Now, look carefully in, on, and right around each bag using the magnifying glass. Draw a picture of any organisms, or animal signs that you find, in your notebook below the appropriate bag label. Look for insects, other invertebrates, fungi (fuzz or furry coatings or mushrooms).
4. Use the forceps to carefully pick up each bag and look underneath it. Use the hand lens to examine anything you find. Draw pictures of any new types of detritivores you find.
5. Compare the kinds of detritivores you found on each type of rotting material. Were they the same, or different? What differences did you notice? Why might there be differences?
6. Do you notice evidence of any microscopic detritivores?
7. What would the forest look like if all these invertebrates, fungi, and microscopic detritivores weren't around?

CLASSROOM FOLLOW-UP:
Look through the forest wildlife cards and/or books on forest invertebrates and insects to see if you can find pictures of any of the organisms that you observed in the field. If you do, label your drawings. (Hint: Be sure to look up carrion beetles, blow flies, springtails, and molds.)

(Discuss student answers to the questions.)

Students will likely find more animals around the meat and more fungi around the fruit. Like other organisms, detritivores eat specific kinds of food; some eat plants, others eat meat. Rotten smells are evidence of microscopic detritivores. Without detritivores, the forest would soon be filled with dead plants and animals.

Human Activities—Preparation

Place this card at some site along the trail where humans have altered the forest.

Skills: observing, predicting, values clarification
Subjects: Science, Social Studies
Materials: none

Human Activities—Instructions

1. Turn to the next page in your field notebook and label the page "Human Activities and the Forest."
2. Use your seeing, hearing, and smelling senses as you examine this area carefully. Record any evidence of human activity that you find. (Don't forget that past human activities may have disturbed the site and caused this area to be at a different stage of succession than nearby sites.)
3. Review the signs of humans that you found, and put a plus mark by those you think improved the forest, a minus mark by those you think harmed the forest, and a 0 by those you think changed the forest, but had mixed effects. (Remember, a change in the forest may benefit some living things and harm others.)
4. Add any evidence of humans you find elsewhere along the trail to this page in your notebook.

CLASSROOM FOLLOW-UP:

1. Make a class list of human activities students noticed in the forest on the board. Then set up the following headings across the top of the board: Harmed Most Wildlife; Harmed Wildlife That Need Old Forests, Harmed Wildlife That Need Early Successional Stages, Harmed People's Enjoyment of Forest, Other Harm To Forest, Helped Most Wildlife, Helped Wildlife That Need Old Forest, Helped Wildlife That Need Early Successional Stages, Improved People's Enjoyment of Forest, Other Benefits to Forest, and OVERALL EFFECTS. Review each activity and place a check mark in all the columns that apply. Then, based on the number of checkmarks on the positive side versus the number on the negative side, assign an overall +, -, or 0 (neutral) effect symbol in the last column.

4. Have students discuss how the overall effects of each activity might differ if only 1 person did it, or 10, 50, 1000, or everybody--or if it occurred in only a few areas of the forest, or most areas of the forest.

5. Follow-up with Forest Fables or Friends of the Forest, activities described in the Teacher's Guide, Lesson 5, Curriculum Integration.

Forest Sharing—Preparation

This card should be placed at the last site along the trail, and the activity conducted with the entire class.

Skills: communication
Subjects: Language Arts
Materials: a card for each student in the class; each card should have a different descriptive adjective or term written on it. Suggested Terms: prettiest, most interesting, strangest, ugliest, warmest, coldest, most curious, best smelling, worst smelling, darkest, brightest, most red, darkest blue, the brightest yellow, (and other colors), fastest, tallest, smallest, longest, oldest, youngest, most beautiful, loudest, hardest to hear, hairiest, most feathered, most rough, most smooth, most hard, most soft, most prickly, sharpest, etc. (You may also want to add students' favorite slang terms.)

Forest Sharing—Instructions

1. Gather the class in a circle. Pass around a hat with the cards in it and ask each student to draw out one card. Then, ask each student to think carefully about the things they observed in the forest today, and what object best fits the adjective(s) listed on the card they drew.
2. Start with any student and ask them to describe what they saw today that fits the description on their card. You may have them state their answer using the adjectives (i.e. The prettiest thing I saw today was a spruce tree.); OR have students just state what they saw and what they thought or felt about it (without using the adjectives on their card--i.e. I saw a spruce tree. I thought it was beautiful because.....), then have the class try to guess what adjective the student has listed on their card.
3. Have each student in the class describe one thing that they observed before ending this activity.

CLASSROOM FOLLOW-UP:

Have students write descriptive essays, using adjectives, about their trip through the forest.

More Than Just Trees--A Forest Game

Supplement to the
1987 ALASKA WILDLIFE WEEK EDUCATIONAL PACKET
UNIT 5. ALASKA'S FORESTS.

This game for students reviews and reinforces the lessons in the accompanying Teacher's Guide, Learning Trail, and filmstrip series.

MATERIALS: More Than Just Trees--A Forest Game--board and cards (included), a pair of dice and game markers.

PROCEDURE:
Use this game as best suits your teaching situation.
It can be set up and used as a station.
OR
You can make copies of the board and cards, then divide your class into several groups and have each group play the game.
OR
Divide your class into groups and have each group represent one player--each group will have one marker and should confer before answering each question.

MORE THAN JUST TREES-A FOREST GAME--RULES

1. Separate the cards by category, shuffle each group and place them face down on the matching category square.

2. Pick a game marker and roll the dice to see who goes first (lowest number). Play rotates to the player on the left. Place all markers in the START square.

3. On his/her turn, each player rolls the dice and moves ahead the specified number of spaces. Then, the person to the right of this player draws a card from the card pile located in the same part of the board as the player's marker and reads the question from the card. (If any card pile is emptied before all players are out of an area, draw question cards for remaining players from the next card pile on the board.)

4. The player must answer the question or say "I don't know."

4. The person reading declares the answer correct or incorrect. In either case, he/she must read the correct answer as given on the card.

5. If a player answers correctly, he/she gets to keep the question card and remain in place on the board. If a bonus question is listed, he/she may try to answer it.

6. If a player answers incorrectly or cannot answer, he/she must move back the number of penalty spaces indicated on the card. The question card is then returned to the bottom of the deck from which it was taken.

7. If a player answers a bonus question correctly, he/she moves ahead the specified number of spaces. An incorrect answer is not penalized, but the reader must read the correct answer out loud before giving the player the question card.

8. The game is over whenever any player reaches the finish, or all the cards have been taken.

9. The player with the most cards at the end of the game wins.

THE FOREST GAME--CARDS--Tree and Forest Cards

TREES AND FORESTS

QUESTION: Does square 1 show a conifer or a hardwood? How did you know.

ANSWER: A conifer; only conifers have needle-like leaves.

PENALTY: Go Back 3 spaces.

TREES AND FORESTS

QUESTION: What part of a plant obtains water and minerals?

ANSWER: The roots.

PENALTY: Go Back 3 spaces.

TREES AND FORESTS

QUESTION: Give 2 reasons why the branch shown in square 7 could not be from a conifer.

ANSWER: Conifers do not have flat broad leaves or flowers.

PENALTY: Go Back 3 spaces.

TREES AND FORESTS

QUESTION: Square 9 shows a cross-section of a tree trunk. Name the only part of the trunk that is alive and grows.
ANSWER: The cambium, the layer just beneath the bark.

PENALTY: Go Back 2 spaces.

TREES AND FORESTS

QUESTION: Who is this? This animal is common in Alaska's forests, but it is rarely seen because it is active mainly at night. It eats fungi, berries, and seeds. See square 10 for another hint.

ANSWER: Flying squirrel.

PENALTY: Go Back 2 spaces.

TREES AND FORESTS

QUESTION: Name 2 reasons that detritivores are important to forests.

ANSWER: 1) They eat dead leaves and other wastes and 2) by doing so they return minerals to the soil where they can be reused by plants.

PENALTY: Go Back 2 spaces.

TREES AND FORESTS

QUESTION: Square 2 shows a drawing of an Alaska cedar. Is this tree a conifer or a hardwood?
ANSWER: Conifer--notice that it has cones and awl-shaped leaves.
PENALTY: Go Back 4 spaces.
BONUS: Does this tree occur in boreal or coastal forests of Alaska? [If you answered coastal forest, advance 2 spaces.]

TREES AND FORESTS

QUESTION: There may be as many as 250,000 of these insects (shown in Square 13) in a square yard of forest soil. They are able to spring 3-4 inches into the air. What are they called and why are they important?
ANSWER: They are springtails. They are important detritivores that help return minerals to the soil for reuse by plants.
PENALTY: Go Back 2 spaces.

TREES AND FORESTS

QUESTION: The living things shown in square 8 are types of fungi. Are they producers or consumers?
ANSWER: All fungi are consumers, most feed on dead and decaying plants and animals.

PENALTY: Go Back 3 spaces.

TREES AND FORESTS

QUESTION: Which square on this board shows the work of a leaf miner.

ANSWER: Square 5. The larvae of some insects live inside leaves and eat out tunnels or mines. Larvae that feed in this manner are called leaf miners.

PENALTY: Go Back 2 spaces.

2/

TREES AND FORESTS

QUESTION: True or False: An acre of forest can remove 1 ton or more of dust from the air every year.

ANSWER: True.

PENALTY: Go Back 4 spaces.

TREES AND FORESTS

QUESTION: True or False: Trees are the largest living things on earth.
ANSWER: True. The largest tree in Alaska is the Sitka Spruce, it may grow 200 feet tall, and weigh 40 tons. The largest trees, giant sequoias, can grow 300 feet tall, have trunks 40 feet in diameter, and may weigh 2000 tons.
PENALTY: Go Back 2 spaces.

TREES AND FORESTS

QUESTION: True or False: Forests help form rain and snow.
ANSWER: True; Rain and snow caught by trees evaporates into the air AND trees pump water from the soil into the air. By this pumping action, called transpiration, a single tree may return 80 gallons of water to the air in a day! This water vapor helps form clouds, and thus rain and snow.
PENALTY: Go Back 3 spaces.

TREES AND FORESTS

QUESTION: Humans and other animals breathe out carbon dioxide. What is the name of the gas we breathe in, and what do trees have to do with the amount of it in the air?
ANSWER: Oxygen; trees take in carbon dioxide and give off oxygen; an acre of forest produces enough oxygen every day for 8 people.
PENALTY: Go Back 3 spaces.

TREES AND FORESTS

QUESTION: Does the animal shown in square 11 need forests?
ANSWER: Yes. Many kinds of fish depend on forests because forests affect the stream environment. Forests help keep streams clean and full of water; they also provide nutrients and moderate stream temperatures.
PENALTY: Go Back 2 spaces.

TREES AND FORESTS

QUESTION: A tree needs carbon dioxide from the air, water, and minerals from the soil. What else does it need to make food?
ANSWER: Sunlight.
PENALTY: Go Back 6 spaces.
BONUS: What is the name of the gas that plants take out of the air to make food? [Move ahead 2 if you said carbon dioxide.]

TREES AND FORESTS

QUESTION: The animal shown in square 3 lives in forest soil. It has poison fangs and preys on a wide variety of insects and other invertebrates in the soil. Name it and tell what kind of consumer it is.
ANSWER: It is a centipede and it is a carnivore.
PENALTY: Go Back 2 spaces.

TREES AND FORESTS

QUESTION: Square 14 shows some living things that are very important in breaking down waste materials and dead organisms. How many of these are there in a tablespoon of forest soil? (Choose one number--100, 1000, 10,000, 1 million, over 3 billion)
ANSWER: Over 3 billion. (Bacteria.)
PENALTY: Go Back 2 spaces.

TREES AND FORESTS

QUESTION: Name the kind of fungi (see Square 8) that decays heartwood of trees.
ANSWER: Shelf fungus.
PENALTY: Go Back 1 space.
BONUS: Name a living thing that shelf fungi help and explain how they help it. [Move ahead 3 spaces if you answer a) plants by helping return minerals to the soil or b) any cavity-nesting animal by helping form holes in trees.]

TREES AND FORESTS

QUESTION: The animal shown in square 4 eats the cambium of trees during winter. Name it and the kind of consumer it is.
ANSWER: It is a porcupine, and it is a herbivore because it eats plants.

PENALTY: Go Back 3 spaces.

A FOREST GAME--CARDS--Coastal Forest Cards

COASTAL FOREST

QUESTION: Square 27 shows the fruiting part of a living thing. What is the name of the thread-like parts of its main body.
ANSWER: Hyphae. All fungi are made up of these microscopic thread-like parts.
PENALTY: Go Back 2 spaces.
BONUS: If all the hyphae in a tablespoon of forest soil were stretched out, how long would it be? [If you answered 2 miles, move ahead 4 spaces.]

COASTAL FOREST

QUESTION: One animal of the coastal forest builds a large stick nest. It adds sticks to the nest each year. After many years the nest may be 12 feet deep and weigh a ton. Because its nests are so large, it must nest in large, old trees. The average tree it uses in coastal forest is 400 years old. Which square shows this animal?
ANSWER: Square 22, the bald eagle.
PENALTY: Go Back 3 spaces.

COASTAL FOREST

QUESTION: The bird shown in square 18 eats berries, insects, small mammals, bird eggs, and dead animals. What kind of consumer is it?
ANSWER: An omnivore.
PENALTY: Go Back 4 spaces.
BONUS: If you give the name of the bird, you can move ahead 2 spaces. (Answer: Steller's Jay)

COASTAL FOREST

QUESTION: Woodpeckers like the one shown in square 21 dig holes in dead trees. Many animals like chickadees, flying squirrels, and small owls use abandoned woodpecker holes for nesting and roosting. The interaction between the woodpecker and these animals is a kind of ______.
ANSWER: Symbiosis (Commensalism is also correct.)
PENALTY: Go Back 2 spaces.

COASTAL FOREST

QUESTION: The living thing shown in square 20 is a favorite food of bears and deer. This living thing gives off a strange smell and it can actually melt its way up through the snow in spring. What is its major role in the coastal forest?
ANSWER: It is a producer.
PENALTY: Go Back 5 spaces.
BONUS: Go ahead 2 spaces if you can identify it. (Answer: Skunk cabbage.)

COASTAL FOREST

QUESTION: One animal of the coastal forest is rarely eaten because it is covered by a terrible-tasting slime. One type of ground beetle manages to eat it by spitting digestive juices on it first, then scooping it up as pre-digested soup. Can you name this slimy creature--it is shown in square 26.
ANSWER: Banana slug.
PENALTY: Go back 1 space.

COASTAL FOREST

QUESTION: How old are the largest western hemlock trees in the coastal forest? 200-300, 400-500, or 600-800 years
ANSWER: Many of the hemlock trees in the coastal forest are 600-800 years old. They were over 300 years old when Vitus Bering's expedition discovered Alaska!
PENALTY: Go Back 2 spaces.

COASTAL FOREST

QUESTION: The bird shown in square 21 is a Red-breasted Sapsucker. What type of bird is it?

ANSWER: It is a kind of woodpecker.

PENALTY: Go Back 2 spaces.

COASTAL FOREST

QUESTION: The chocolate lily in square 23 depends upon insects to carry its pollen. This interaction is a kind of ______?
ANSWER: Symbiosis. You may move 1 extra space if you said mutualism--a kind of symbiosis from which both species benefit.
PENALTY: Go Back 2 spaces.
BONUS: This flower smells like something dead. Guess what pollinates it and move ahead 3 spaces. (Answer: flies)

COASTAL FOREST

QUESTION: The animal in square 16 is named for its large eyes which are similar to another herbivore of the coastal forest. What does this animal eat?
ANSWER: If you listened carefully you know it is a herbivore, so it must eat plants or other producers!
PENALTY: Go Back 5 spaces.
BONUS: Name it for 2 extra spaces. (Answer: white-footed deer mouse)

COASTAL FOREST

QUESTION: The animal shown in square 17 lives in the coastal forest but has to return to water to have its young. It can breathe through its moist skin, but also has lungs. What kind of animal is it?
ANSWER: An amphibian; the one shown is a long-toed salamander.
PENALTY: Go Back 2 spaces.

COASTAL FOREST

QUESTION: What 3 things are missing from the following food chain: skunk cabbage, deer, wolf
ANSWER: 1) sunlight and 2) minerals from the non-living environment are needed in order for the skunk cabbage to produce food, and 3) some kind of detritivore is needed to recycle the minerals back to the non-living environment.
PENALTY: Go Back 4 spaces.

COASTAL FOREST

QUESTION: True or False: The tiny bird shown in square 19 is a carnivore.

ANSWER: True. Winter wrens feed on insects and soil invertebrates, which are consumers, so they are carnivores.

PENALTY: Go Back 3 spaces.

COASTAL FOREST

QUESTION: The living things shown in the following squares are found only or mainly in one type of Alaskan forest: 16, 17, 18, 19, 20, 21, 23, 24, and 26. Which type of forest are they found in?

ANSWER: Coastal forest

PENALTY: Go Back 5 spaces.

COASTAL FOREST

QUESTION: Find 2 signs of herbivores in square 25.
ANSWER: 1) the holes in the leaf show evidence of a leaf-chewing insect and 2) the leaf that is rolled up shows evidence of a leaf-rolling insect. Leaf rollers roll up the leaf to hide from predators, then eat the leaf's inner surface.
PENALTY: Go Back 2 spaces.

COASTAL FOREST

QUESTION: One animal that lives in the coastal forest could not digest its foods without the symbiotic bacteria that live in its digestive system. Which square shows this animal? Hint, it has hooves.
ANSWER: 24, the Sitka black-tailed deer.
PENALTY: Go Back 3 spaces.
BONUS: Name the kind of interaction described above and move ahead 3 spaces. (Answer: Symbiosis, or mutualism.)

COASTAL FOREST

QUESTION: Two kinds of organisms join together in a symbiotic interaction to form the lichen shown in square 48. Name them.
ANSWER: A fungi and an algae. (Or, a fungi and a cyanobacteria.)
PENALTY: Go Back 1 space.
BONUS: If you can tell whether a lichen is a producer or consumer, you can move ahead 4 spaces. (Answer: A producer.)

COASTAL FOREST

QUESTION: All living things in a forest ecosystem are interdependent because of what two kinds of connections?
ANSWER: Food webs (or chains) and symbioses -- the two kinds of interactions and interdependence between living things that occur in all ecosystems.
PENALTY: Go Back 4 spaces.

COASTAL FOREST

QUESTION: The animal shown in square 6 eats voles, mice and shrews. What is its name and what kind of consumer is it?
ANSWER: It is a marten and it is a carnivore.
PENALTY: Go Back 2 spaces.
BONUS: Identify the 3 squares that show a marten's prey and move ahead 3 spaces. (Answer: 16-mouse, 32-vole, and 51-shrew.)

COASTAL FOREST

QUESTION: Name 3 reasons why we should care about conservation of forests.
ANSWER: Forests have many values. They 1) provide us with wood for fuel, building, paper and other uses; 2) clean and purify the air; 3) break the wind; 4) help keep streams and underground water supplies clean and full of water; 5) provide habitat for many wildlife, and 6) are places for recreation.
PENALTY: Go Back 4 spaces.

FORESTS AND CHANGE

QUESTION: To manage forests wisely, forest managers must know what people want from the forest, and be able to accurately predict what else?

ANSWER: How human activities will affect the forest ecosystem.

PENALTY: Go Back 2 spaces.

FORESTS AND CHANGE

QUESTION: Hares eat plants that are most abundant in shrub thickets created by fires and succession. Lynx den in old forest and eat hares. Will there be more or fewer lynx if most forest fires are put out.
ANSWER: Fewer. Lynx eat hares. Hares are most abundant in shrub thickets. Lack of fire means fewer shrub thickets, fewer hares, and less food for lynx.
PENALTY: Go Back 2 spaces.

FORESTS AND CHANGE

QUESTION: Name 2 likely changes in a stream caused by forest removal along it.
ANSWER: The stream would likely 1) carry more silt due to increased erosion; 2) carry more water after rain or snowmelt, but less during dry periods; 3) contain fewer leaves from trees and understory forest plants, and thus fewer insects and fish; 4) water temperature might change.
PENALTY: Go Back 3 spaces.

FORESTS AND CHANGE

QUESTION: True or False: Trees return water to the air, so removal of trees would allow more water to seep into the ground.
ANSWER: False. Trees do return water to the air, but trees prevent soil erosion, help water to seep into the soil, and their decayed leaves form organic soil which stores water. Thus, more water seeps into the ground in forested areas than in non-forested areas.
PENALTY: Go Back 4 spaces.

FORESTS AND CHANGE

QUESTION: True or False: Many living things that occur in old forests can not live in early seral stages.

ANSWER: True.

PENALTY: Go Back 3 spaces.

FORESTS AND CHANGE

QUESTION: Name 2 changes you'd expect if large forest areas were cleared.
ANSWER: 1) Rivers and streams may flood more frequently, 2) soil erosion will increase, winds may become more severe, 3) temperatures of air and soil will reach higher and lower extremes, 4) precipitation will decrease, and 5) forest wildlife will become rare.
PENALTY: Go Back 3 spaces.

FORESTS AND CHANGE

QUESTION: True or False: Trees create air pollution.
ANSWER: False. Trees clean and purify the air. An acre of forest removes over a ton of dust and other pollutants from the air each year. In addition, an acre of forest removes a ton of carbon dioxide, and returns 1500 pounds of oxygen to the air every year.
PENALTY: Go Back 6 spaces.

FORESTS AND CHANGE

QUESTION: True or False: Litter is ugly, but it doesn't really hurt anything.
ANSWER: False. Many kinds of litter can kill or injure wildlife. Animals can get entangled and die in monofilament fish line or plastic holders on 6-packs of pop; small animals are often trapped and die in bottles or cans, and some animals mistake certain litter for food and die after eating it.
PENALTY: Go Back 4 spaces.

FORESTS AND CHANGE

QUESTION: True or False: Air pollution can kill trees.
ANSWER: True. In fact, forests in many parts of Europe, Canada, and the Lower 48 are being killed by air pollution. Some small areas of Alaskan forest have also been killed by air pollution. You can help reduce air pollution by conserving energy and recyling paper and aluminum.
PENALTY: Go Back 3 spaces.

FORESTS AND CHANGE

QUESTION: True or False: If you break off a large branch of a tree, or cut off a piece of its bark, the tree may eventually die.
ANSWER: True. The bark provides protection against insects and diseases. If a piece of bark is removed, these can easily attack the tree and may eventually kill it.
PENALTY: Go Back 3 spaces.

THE FOREST GAME--CARDS--Forests and Change

FORESTS AND CHANGE
QUESTION: The bird in Square 44 likes open areas, nests on the ground, and eats seeds of grasses, and insects; Square 50 shows a bird that nests in old aspen and eats mainly squirrels and grouse. How would a forest fire affect the habitats of sparrows and goshawks?
ANSWER: It would create habitat for sparrows and reduce habitat for goshawks.
PENALTY: Go Back 3 spaces.

FORESTS AND CHANGE
QUESTION: The bird in square 39 survives winter by eating the needles of spruce trees. Do forest fires improve or reduce habitat for spruce grouse?
ANSWER: Reduce habitat. Fire kills spruce trees. Though other plants quickly invade a burn site, 50 years or more must pass before large spruce trees grow back. Grouse can't use the site until they do.
PENALTY: Go Back 4 spaces.

FORESTS AND CHANGE
QUESTION: The animal shown in square 24 feeds on groundcover plants and low shrubs. Could it survive in a second-growth forest of dense conifers in which little sunlight reached the forest floor?
ANSWER: No, since little sunlight reaches the forest floor, few shrubs or groundcover plants could grow and little food would be available for deer.
PENALTY: Go Back 2 spaces.

FORESTS AND CHANGE
QUESTION: The main foods of the animal shown in square 28 are the leaves and branches of willow shrubs and birch saplings. They cannot reach the leaves or branches of trees. Do forest fires help create or reduce the habitat of this animal?
ANSWER: Fires create clearings, which through succession become shrub thickets, so fires help make habitat for moose.
PENALTY: Go Back 2 spaces.

FORESTS AND CHANGE
QUESTION: What kind of interaction does the drawing in square 41 depict.
ANSWER: Symbiosis is the correct answer. It shows pollination of a flower by a butterfly which is an example of symbiosis. (Award 1 extra space if the answer given was mutualism, because usually both species benefit from pollination.)
PENALTY: Go Back 2 spaces.

FORESTS AND CHANGE
QUESTION: The bird in square 31 feeds on insects that live on trees and tall shrubs. It nests in old woodpecker holes in dead trees. Would you find it in a pioneer stage forest?
ANSWER: No. In the pioneer stage, only low growing plants are present and there are no trees for chickadees to feed or nest in.
PENALTY: Go back 4 spaces.

FORESTS AND CHANGE
QUESTION: The seeds of raspberry (square 49) can survive a trip through the stomach of the animal in square 42. How might this berry plant spread into recently disturbed areas (like burns, logged sites, etc.)?
ANSWER: Their seeds might be carried in by bears.
PENALTY: Go Back 3 spaces.

FORESTS AND CHANGE
QUESTION: Who do most of the forests in Alaska belong to?
ANSWER: Most of Alaska's forests are on state or federal land, so they belong to you, me, and all other United States citizens.
PENALTY: Go Back 3 spaces.
BONUS: Name the people who need to help take care of public forests and you can move ahead 4 spaces. (They belong to everyone, so all of us must help care for them.)

FORESTS AND CHANGE
QUESTION: The animal shown in square 42 often dens in large, dead, hollow trees. Could it find this kind of den in a young forest?

ANSWER: No. Young forests contain mainly small trees and few dead ones.

PENALTY: Go Back 2 spaces.

FORESTS AND CHANGE
QUESTION: Square 51 and 32 animals need lots of fallen logs and groundcover plants for cover. Weasels need lots of voles and shrews to eat. Where would you expect to find more weasels, in an area burned this year, or an old forest?
ANSWER: Old forest because it would contain more fallen logs and ground cover plants--cover needed by a weasel's prey.
PENALTY: Go Back 3 spaces.

BOREAL FOREST

QUESTION: About 90 percent of the plants in Alaska need certain fungi to help them obtain minerals from the soil. What are these fungi called?
ANSWER: Mycorrhizal fungi; these grow on or around plant root hairs; the fungi provide minerals to the plant and the plant provides sugars to the fungi.
PENALTY: Go Back 2 spaces.

BOREAL FOREST

QUESTION: The bird shown in square 38 lives in old black spruce forests and old burn sites. It feeds on voles. Is it an owl or a hawk?
ANSWER: It is an owl. It is called the Northern Hawk-Owl because its long tail makes it look like some hawks.
PENALTY: Go Back 2 spaces.

BOREAL FOREST

QUESTION: How many squares on the game board show a consumer?
ANSWER: 37 squares show consumers (38 if the fungi half of the lichen is counted as a consumer). (3, 4, 6, 8, 10, 11, 13, 14, 16, 17, 18, 19, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 35, 36, 37, 38, 39, 41(butterfly), 42, 43, 44, 47, 48, 50, 51)
PENALTY: Go Back 2 spaces.

BOREAL FOREST

QUESTION: Few things can eat the needles of spruce trees because they taste like turpentine. Yycch! The animal shown in square 39 eats only spruce needles in winter. What is it?
ANSWER: A spruce grouse. These birds eat the needles at the top of the tree and new buds which contain fewer bad-tasting chemicals than older, or lower branches.
PENALTY: Go Back 2 spaces.

BOREAL FOREST

QUESTION: What evidence of an insect do you see in square 45.
ANSWER: The large round bulb on the branch is a gall, or an abnormal growth on the plant caused by an insect. The larvae of the insect are inside the gall. They eat the gall or sap of the plant.
PENALTY: Go Back 1 space.
BONUS: Name this interaction and move ahead 1 space. (Symbioses or parasitism.)

BOREAL FOREST

QUESTION: How do voles help plants and fungi? Hint: The living thing in square 32 eats berries, seeds, and fungi. It also collects and stores these, and thus scatters them through the forest.
ANSWER: Voles carry seeds of plants and spores of fungi to new areas where they can grow. Thus they help plants and fungi spread through the forest and to new areas.
PENALTY: Go Back 2 spaces.

BOREAL FOREST

QUESTION: The tree in square 46 is deciduous; it loses its leaves in fall. Is it a hardwood or a conifer?
ANSWER: Conifer. Most conifers are evergreen, and in fact keep each of their needles for 5-7 or more years, but some conifers, like this tamarack, are deciduous. (Also, some hardwoods are evergreen rather than deciduous.)
PENALTY: Go Back 4 spaces.

BOREAL FOREST

QUESTION: If you walked through the forest and saw the animals in squares 28, 29, 33, 35, 36, 38, and 39, what kind of forest would you most likely be walking in --boreal or coastal forest?

ANSWER: Boreal forest.

PENALTY: Go back 3 spaces.

BOREAL FOREST

QUESTION: The organisms in square 40 are able to manufacture carbohydrates, or sugars, from water, sunlight, and carbon dioxide. Are they producers or consumers?
ANSWER: Producers--only producers can make food from non-living things.
PENALTY: Go Back 4 spaces.
BONUS: Move ahead 3 if you name this food-making process. (Photosynthesis)

BOREAL FOREST

QUESTION: The animal in square 51 preys on insects. What kind of consumer is it?

ANSWER: A carnivore.

PENALTY: Go Back 4 spaces.

THE FOREST GAME--CARDS--Boreal Forest Cards

BOREAL FOREST

QUESTION: Which square shows the large, hooved animal that is missing from this food chain: sunlight and minerals--willow--wolf--bacteria?
ANSWER: Square 28, the moose.
PENALTY: Go Back 4 spaces.
BONUS: Move ahead 2 spaces if you can name the kind of consumers that moose represent. (Answer: herbivores)

BOREAL FOREST

QUESTION: The long-horned beetle in square 37 feeds on the cambium of trees. It can smell the smoke from burning wood from 25 miles away. How could this ability be helpful to it.
ANSWER: It can quickly find recently burned forests which contain many dead and dying trees. Such trees cannot defend their cambium against beetle attacks.
PENALTY: Go Back 3 spaces.

BOREAL FOREST

QUESTION: The animal shown in square 29 is the only kind of wild cat that occurs in Alaska. What is it and why do its populations grow and decline following similar changes in snowshoe hare populations?
ANSWER: A lynx; Its numbers change because hares are its main food.
PENALTY: Go Back 2 spaces.

BOREAL FOREST

QUESTION: The black-backed woodpecker shown in square 35 feeds on beetles that live beneath the bark of trees. These beetles are most abundant where there are many dead and dying trees. Would you expect to find this woodpecker in a forest area that had recently burned?
ANSWER: Yes; a forest fire creates a habitat with many dead and dying trees.
PENALTY: Go Back 2 spaces.

BOREAL FOREST

QUESTION: Birch saplings make bad-tasting chemicals after repeated browsing by square 36 animals. These animals won't eat birch with lots of bad-tasting chemicals, even though it is their main food. How might birch affect populations of the animal?
ANSWER: Once most of the birch have been heavily browsed, hares are not able to find enough edible food, and may starve.
PENALTY: Go Back 2 spaces.

BOREAL FOREST

QUESTION: The abnormal growth on the conifer in square 34, called a witches broom, is caused by a rust (a type of fungi). The tree cannot use the minerals and energy used to form the witches broom for other uses. Is this a symbiosis?
ANSWER: Yes; it is a type of symbiosis called parasitism; one organism (rust) benefits while the other (tree) is harmed.
PENALTY: Go back 2 spaces.

BOREAL FOREST

QUESTION: The bird shown in square 30 has a bill that crosses at the tips. This bill is specially designed to help the bird get seeds out of conifer cones. Conifer seeds are their primary food. Would you expect to find this bird in a forest of hardwood trees? Name it for an extra point.
ANSWER: No; crossbills couldn't live in a forest that didn't provide their major food.
PENALTY: Go Back 3 spaces.

BOREAL FOREST

QUESTION: The bird shown in square 33 eats berries, insects, small mammals, eggs, and dead animals. What kind of consumer is it?
ANSWER: An omnivore.
PENALTY: Go Back 3 spaces.

BOREAL FOREST

QUESTION: The bird shown in square 31 can not dig holes in trees but needs one for nesting and roosting. What kind of animal does it depend upon to dig out holes in trees.
ANSWER: A woodpecker.
PENALTY: Go Back 2 spaces.
BONUS: Name the bird in square 31 and you can move ahead 2 spaces. [Answer: A chickadee.]

BOREAL FOREST

QUESTION: Which 3 animals on the game board get minerals and energy mainly by eating animals like the one shown in square 32?
ANSWER: 6---marten; 38--hawk-owl; 47--weasel.
PENALTY: Go Back 3 spaces.
BONUS: Name it and move ahead 2 extra spaces. (Answer: vole)

FOREST WILDLIFE CARDS

The following pages contain over 150 illustrations of living things found in Alaska's forests. Each illustration is accompanied by text describing the organism's traits, habitat, foods, predators, and examples of their symbiotic associations.

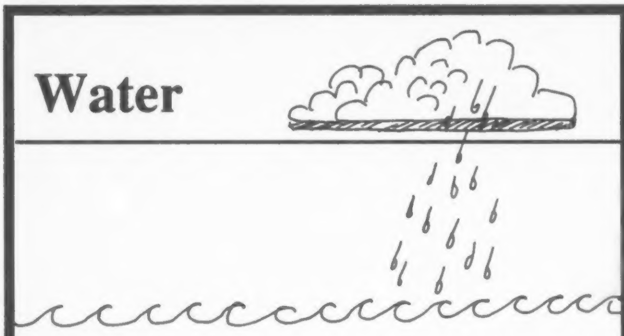
The most common and easily recognized plants, animals, fungi, and microscopic organisms found in Alaska's forests are represented in these cards. The cards represent a variety of taxonomic levels because some organisms are more easily identified than others. Thus many of the bird and mammal cards represent a single species of animal. In contrast, most of the invertebrate, fungi, and microscopic organism cards represent large groups of organisms--either families, orders, or classes. Students should recognize that each of these latter cards actually represent many different species of organisms, each with more specific traits, habitat needs, food habits, and symbiotic ties. (Thus, for example, although your students will be able to develop a complicated-looking food web, and identify a wide variety of symbioses using the cards, the actual food web and symbiotic interconnections in any Alaskan forest is actually far more complicated than can be represented by these cards.)

Most of the organisms included occur in both boreal and coastal forest. You can separate out those that live in only one forest type by reading the HABITAT NEEDS information on each card.

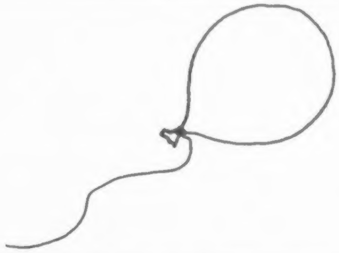
How To Use the Forest Wildlife Cards

- Use the cards for handy reference information on forest wildlife--traits, food habits, habitat needs, and symbiotic associations.
- Cut up and laminate them for use in many of the activities described in the Teacher's Guide.
- Cut up and laminate them to use them as flashcards, for card games, or concentration games.
- Photocopy the illustrations and cut them out. Have students color the photocopies to make wildlife badges.
- Use an opaque projector to enlarge the drawings for worksheets, displays, life-size cut-outs, or other uses.
- Students can try to match specimens collected in the field with a card of a similar organism, to make up their own keys, or for discovering taxonomic relationships among living things.

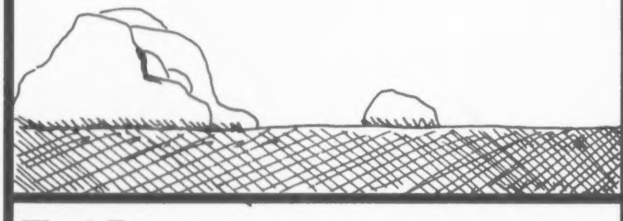
Water



Air

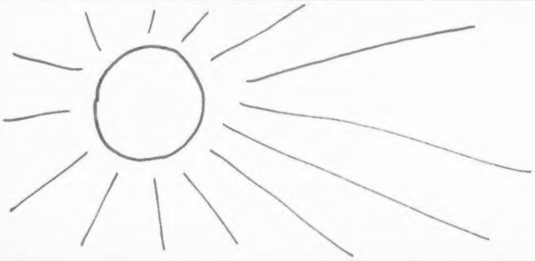


Rocks and Soil

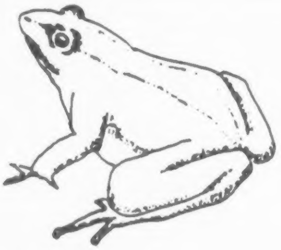


Sunlight

(and other forms of energy)



Wood Frog

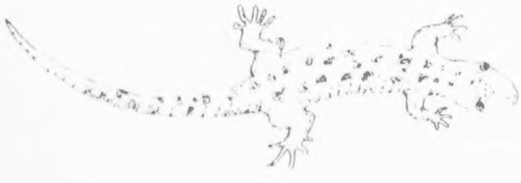


Length: up to 6.5 cm (bouy only)

Wood Frog **Animal**

TRAITS: small animal with moist skin, and no scales or claws, long hind legs, short forelegs, large mouth
HABITAT: forests, muskegs, and tundra; eggs and larvae live only in water, adult lives
FOODS: adults eat insects, including flies (of all types), true bugs, lacewings, dragonflies, and other insects; larvae feed on algae and small aquatic animals
EATEN BY: jays, crows, mink
SYMBIOSES: unknown

Salamanders and Newts



Length: 12.5 - 15 cm (includes tail)

Salamanders and Newts **Animal**

TRAITS: small animals with moist skin, no scales or claws, short fore and hind legs, long tail
HABITAT: moist habitats; in Alaska, they are found only in coastal forests
FOODS: small insects, springtails, beetles, flies,
EATEN BY: jays, crows, mink, shrews
SYMBIOSES: unknown

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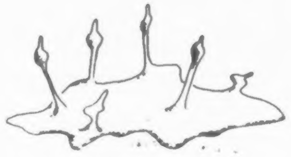
Slime Molds

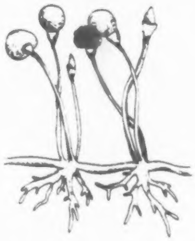


Size: microscopic to thin slime-like coating

Slime Molds **Fungi or Protist ***

TRAITS: appearing as a slime-like covering on logs, trees, or moist soil; sometimes covered with small flag-like fruiting bodies; during part of its life it slowly rolls along like an amoeba and leaves a trail of slime
HABITAT: wet, shaded locations in forests
FOODS: engulfs bacteria and other microscopic organisms
EATEN BY: unknown
SYMBIOSES: unknown
* The classification of slime molds is still being debated; some scientists consider them fungi, others consider them to be better classified as protists

Molds, Mildews, and Rusts

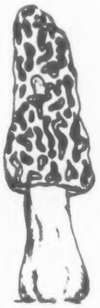


Size: microscopic to a few mm

Molds, Mildews, and Rusts **Fungi**

TRAITS: apparent as a fine powder, fuzz, or furry coating on leaves or other plant parts or animal droppings; or as an abnormal growth
HABITAT: dead plants or waste materials; or, certain kinds occur on living plants or insects
FOODS: feed on dead plant materials (but rarely on wood); some species live as parasites on plants or insects
EATEN BY: springtails, bacteria
SYMBIOSES: some of these fungi, particularly rusts, are parasites of plants and cause abnormal growths such as galls or witches brooms

Morels

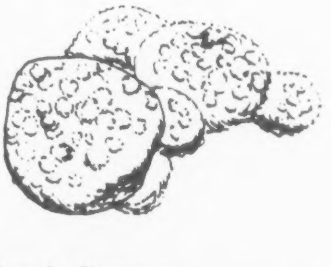


Size: up to 10 cm

Morels **Fungi**

TRAITS: mushroom-like fungi; the top of the fruiting body or mushroom is ridged and pitted
HABITAT: varies by species; spruce forests, old burns
FOODS: dead plant material and animal wastes
EATEN BY: squirrels, voles, mice
SYMBIOSES: unknown

Truffles

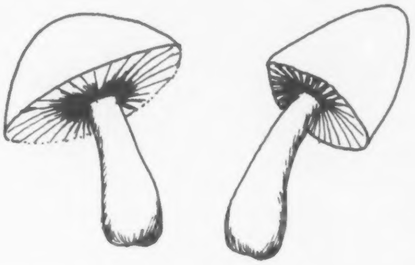


Size: up to 5 cm in diameter

Truffles **Fungi**

TRAITS: a type of fungi that produce underground fruiting bodies that look like spongy balls
HABITAT: underground in forests; most species associate with a specific kind of plant
FOODS: lives on the sugar supplied by the plant it associates with and on minerals absorbed from the soil
EATEN BY: flying squirrels, voles
SYMBIOSES: these fungi are very important due to the mycorrhizal associations they form with trees and other forest plants; these fungi depend upon the organisms that eat them to spread their spores throughout the forest

Gilled Mushrooms

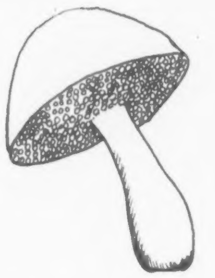


Size: 1 - 20 cm

Gilled Mushrooms **Fungi**

TRAITS: fungi with fruiting bodies that consist of a stalk and cap; the underside of the cap is divided by slits and projections called gills
HABITAT: soil and rotting logs in forested areas; some kinds also occur in other habitats
FOODS: mainly dead plant material and animal wastes
EATEN BY: red and flying squirrels, voles, deer, mice, moose, caribou, humans, millipedes, flies
SYMBIOSES: some of the gilled mushrooms form mycorrhizal associations with certain plants; they receive sugar from the plant and help it obtain nutrients from the soil.

Bolete Mushrooms

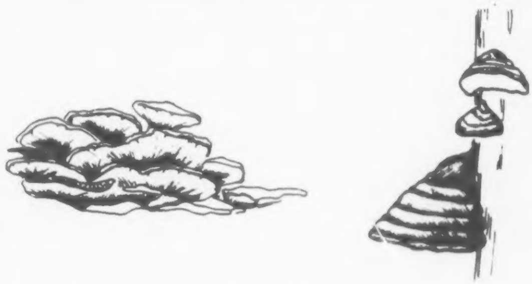


Height: 1 - 30 cm

Bolete Mushrooms **Fungi**

TRAITS: fungi with fruiting bodies that consist of a stalk and cap; the underside of the cap is made up of many tubes; it looks like a dense honeycomb or sponge
HABITAT: soil, litter, or rotting logs in forests; some species live in other habitats
FOODS: rotting leaves or other plant material, and animal droppings
EATEN BY: squirrels, voles, flies, beetles, moose, caribou, and humans
SYMBIOSES: some of the bolete mushrooms form mycorrhizal associations with certain plants; they receive sugar from the plant and help it obtain nutrients from the soil

Shelf Fungi or Polypores

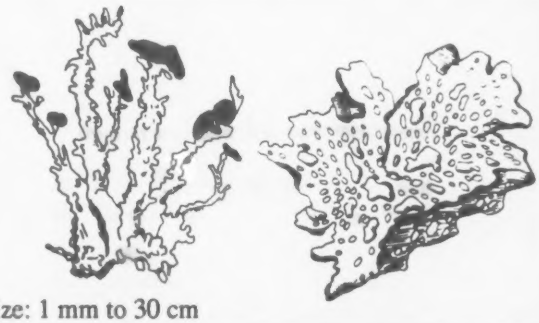


Size: a few mm to 40 cm wide

Shelf Fungi or Polypores **Fungi**

TRAITS: fungi with a fruiting body, called a conk, which emerges from trees or logs and forms a shelf-like structure; the conks grow and produce spores each year
HABITAT: old trees, logs, or other wood
FOODS: dead wood
EATEN BY: millipedes, and a wide variety of insects
SYMBIOSES: some species of shelf fungi are parasites on living trees; their hyphae slowly decay the dead heartwood of the tree and may attack living parts of the tree as well; eventually the tree may be weakened and killed

Lichens



Size: 1 mm to 30 cm

Lichens **Fungi (with a Protist)**

TRAITS: visible as a crust, or as a flat, hairlike, or branched structure; crumbles when dry, but soft when wet
HABITAT: rocks, logs, tree branches, soil
FOODS: makes its own
EATEN BY: deer, caribou, voles, springtails
SYMBIOSES: made up of two separate organisms living together; usually an algae (protist) and a fungi, but some are formed by a cyanobacteria (moneran) and a fungi; the algae or cyanobacteria capture energy through photosynthesis while the fungi provides a protective shell and may help absorb nutrients from rainwater or the surroundings

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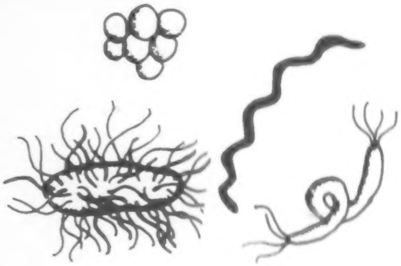
Bacteria



Size: microscopic

Bacteria Moneran

TRAITS: microscopic; lack a cell nucleus

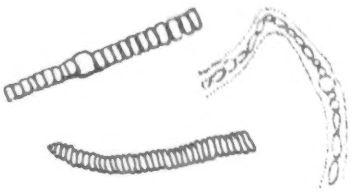
HABITAT: different species have different requirements, but some types of bacteria are found in any moist environment; a tablespoon of forest soil may contain 3-10 billion bacteria

FOODS: mainly dead plant, fungi, and animal material; some kinds of bacteria live as parasites of living things, and some are able to make their own food

EATEN BY: protozoans, some fungi

SYMBIOSES: some bacteria live as parasites of plants, animals, or fungi and cause diseases of these organisms; other kinds live in the digestive tracts of animals and aid in digestion of their foods

Cyanobacteria



Size: microscopic

Cyanobacteria Moneran

TRAITS: microscopic; lack a cell nucleus; containing chlorophyll, often visible as a scum on the surface of water, wet rocks, or logs

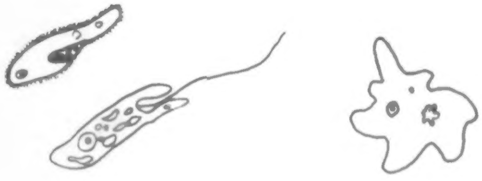
HABITAT: standing water, wet rocks, logs, moss

FOODS: most are able to make their own food through photosynthesis

EATEN BY: protozoans, springtails

SYMBIOSES: some cyanobacteria join with fungi to form lichens; they benefit from this symbiosis through the shelter from drying out provided by the fungi; the fungi may also provide more nutrients for growth

Protozoans



Size: microscopic

Protozoans Protists

TRAITS: microscopic organisms with a cell nucleus; most are able to move around using flagella, cilia, or in an amoeboid fashion

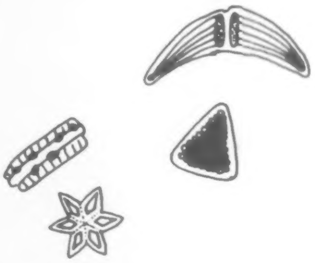
HABITAT: in water, or droplets of water on leaf surfaces, forest litter, under rocks, or in soil

FOODS: varies by species; many eat dead plant material and animal wastes; others feed on bacteria, cyanobacteria, algae, or other protozoans

EATEN BY: protozoans, roundworms, segmented worms

SYMBIOSES: some live in the intestines of certain animals and aid them in digestion of their foods

Algae



Size: microscopic to filaments visible to naked eye

Algae Protists

TRAITS: microscopic organisms with a cell nuclei; most contain chlorophyll

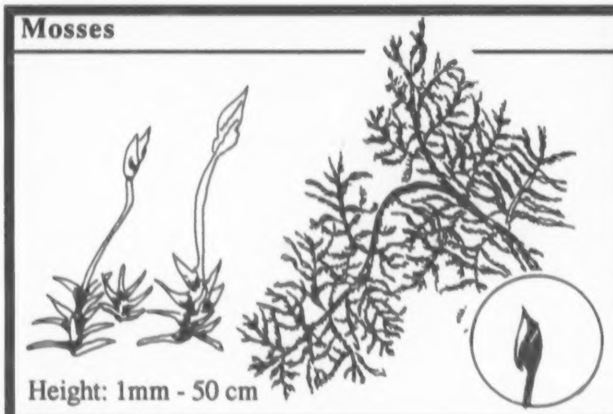
HABITAT: in water or films of water on soil, rocks, tree branches, or logs

FOODS: most algae are able to make their own food through photosynthesis

EATEN BY: protozoans, roundworms, segmented worms, springtails, mites

SYMBIOSES: some algae join with certain fungi to form lichens

Mosses

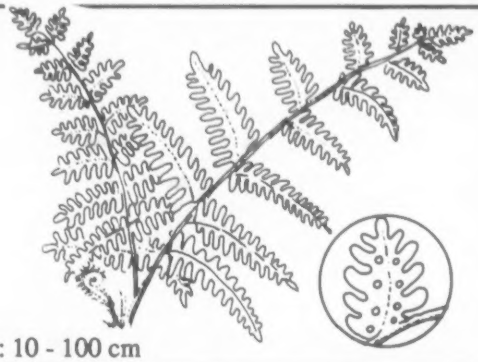


Height: 1mm - 50 cm

Mosses and Liverworts *Atracheata* **Plant**

TRAITS: small plants; either flat and scale-like or with stems and leaves, but all lacking water conducting cells and true roots; they reproduce by spores that are borne in cap-like structures, or capsules, at the tips of long stalks
HABITAT: soil, tree branches, and rocks in forested areas, and other moist habitats
FOODS: makes its own
EATEN BY: springtails, mites
SYMBIOSES: unknown

Ferns

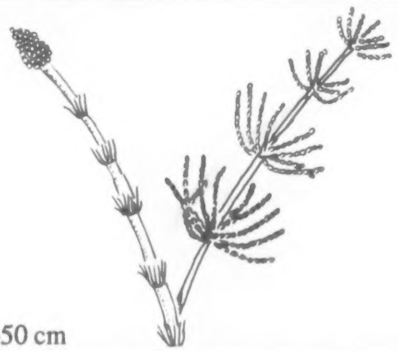


Height: 10 - 100 cm

Ferns *Polypodiophyta* **Plant**

TRAITS: plants with stems, leaves, and roots; most have stems that grow underground; leaves (called fronds) are usually divided into very fine parts; reproduces by spores borne on the undersides of the leaves or on special fronds
HABITAT: moist habitats; most common in coastal forest
FOODS: makes its own
EATEN BY: grouse, deer, hares, springtails, slugs
SYMBIOSES: unknown

Horsetails

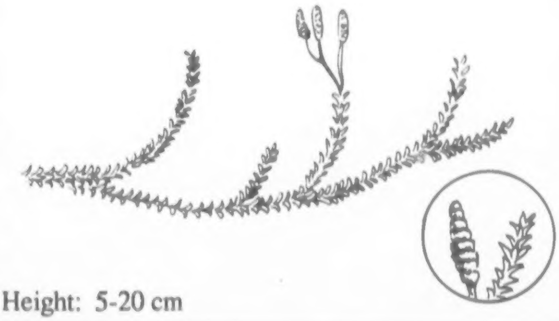


Height: 10-50 cm

Horsetails *Equisetum spp.* **Plant**

TRAITS: ground cover plants with distinctly jointed stems that grow from an underground rhizome; reproduce by spores borne in a cone-like structure at the tips of the stem, or on special stems
HABITAT: wet or moist soils in forests and open areas
FOODS: makes its own
EATEN BY: bears, grouse, moose
SYMBIOSES: unknown

Club Mosses



Height: 5-20 cm

Club Mosses *Lycopodiaceae* **Plant**

TRAITS: ground cover plant; moss-like herb; stems may grow upward or along the ground; tiny, 1-veined leaves grow in pairs, or spirals around the stem; the spores are usually borne in structures that look cone-like and are located at the tips of upright stalks
FOODS: makes its own
EATEN BY: springtails, mites
SYMBIOSES: unknown

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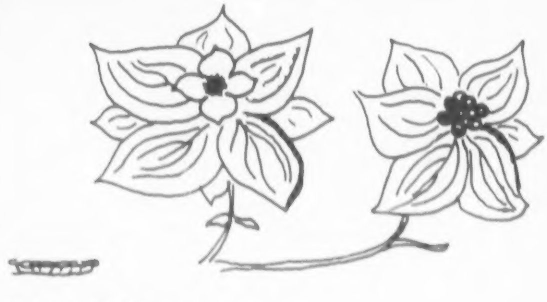
Bunchberry

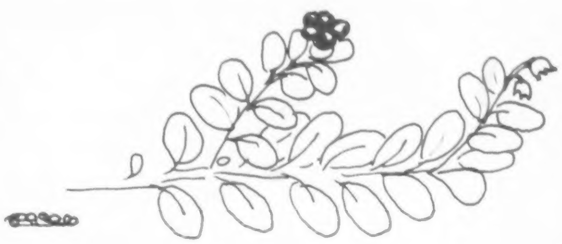


Height: 10-20 cm

Bunchberry *Cornus canadensis* **Plant**

TRAITS: ground cover plant; 4-6 oval shaped leaves arranged in a circle around central flower cluster; tiny flowers surrounded by white petal-like bracts; fruits with clusters of red berries
HABITAT: grows best in mature and old-growth coastal and boreal forests
FOODS: makes its own
EATEN BY: aphids, moth larvae, true bugs, leaf hoppers, pine grosbeaks, thrushes, sparrows, red squirrels, voles, mice
SYMBIOSES: Depends upon mycorrhizal fungi to help it obtain soil nutrients; depends upon insects to pollinate its flowers; animals help scatter its seeds

Lingenberry

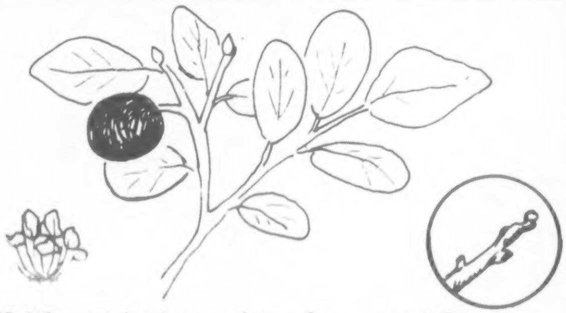


Height: 5-15 cm

Lingenberry *Vacinium vitis-idaea* **Plant**

TRAITS: ground cover plant; small, thick oval leaves; small white to pink bell-shaped flowers; fruit a small red berry
HABITAT: boreal forest; grows best in young, mature, and old-growth forest sites
FOODS: makes its own
EATEN BY: moth larvae, aphids, gall-making aphids, leaf hoppers, true bugs, spruce and ruffed grouse, pine grosbeaks, waxwings, thrushes, voles, moose, bears
SYMBIOSES: needs mycorrhizal fungi to help it get soil nutrients; parasitized by rusts and rots; depends upon insects (???) to pollinate its flowers

Blueberry and Huckleberry

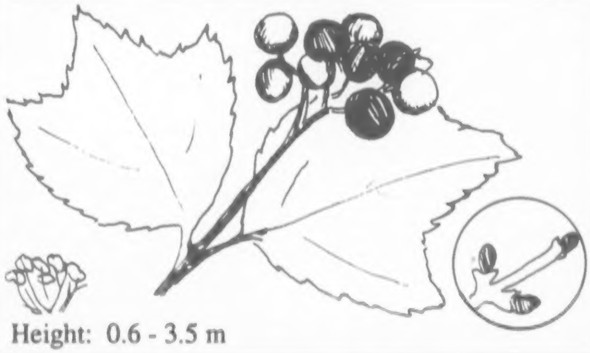


Height: varies by species; a few cm to 1.5 m

Blueberry and Huckleberry *Vaccinium spp.* **Plant**

TRAITS: shrub; small oval leaves with smooth edges; small, bell-like flowers; blue, black, or red berries
HABITAT: grows best on well-drained soils in wet, moderate climate
FOODS: makes its own
EATEN BY: moth larvae, aphids, gall aphids, certain flies, true bugs, leaf hoppers, slugs, snails, deer, pine grosbeaks, jays, voles, mice, thrushes, bears
SYMBIOSES: depends upon mycorrhizal fungi to help it obtain nutrients from the soil; depends upon insects to pollinate its flowers

High Bush-cranberry



Height: 0.6 - 3.5 m

High Bush-cranberry *Viburnum edule* **Plant**

TRAITS: shrub; 3-lobed leaves (2.5-10 cm long); grow in pairs along the stems; white flowers grow in clusters at the ends of short twigs; bright red berries
HABITAT: boreal forest, including tall shrub thickets through mature forest successional stages; grows best in well-drained, warm sites
FOODS: makes its own
EATEN BY: moth and butterfly larvae, leaf hoppers, true bugs, aphids, other insects, ruffed and spruce grouse, pine grosbeaks, voles, moose, hares, bears
SYMBIOSES: depends upon insects to carry its pollen; depends upon mycorrhizal fungi to help it obtain nutrients from the soil

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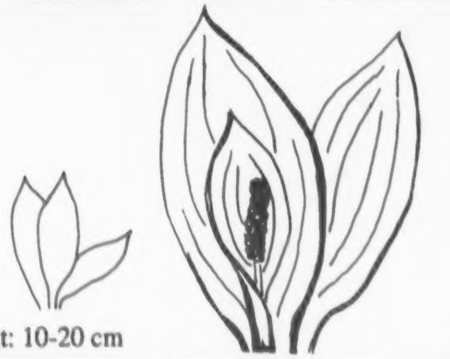
Skunk Cabbage

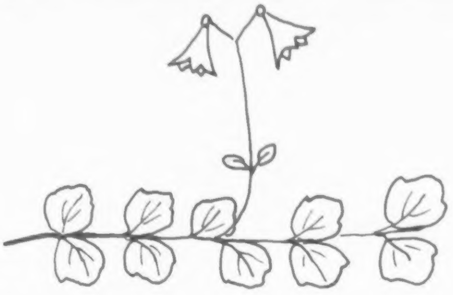


Height: 10-20 cm

Skunk Cabbage *Cornus canadensis* **Plant**

TRAITS: ground cover plant; very large (100 cm) long leaves with smooth edges; flowers borne on a spike surrounded by a bright yellow modified leaf; produces heat by a chemical reaction to melt snow and allow its leaves to quickly emerge in spring
HABITAT: wet, shaded locations in coastal forest
FOODS: makes its own
EATEN BY: slugs, bears, deer
SYMBIOSES: depends upon flies to pollinate its flowers; attracts these pollinators with a skunk-like odor

Twinflower

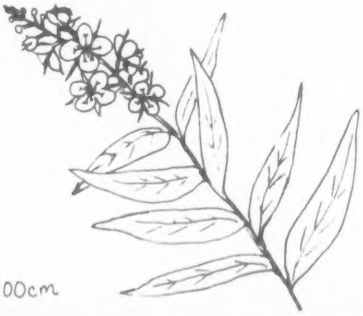


Height: 10cm

Twinflower *Linnaea borealis* **Plant**

TRAITS: ground cover plant; small, oval leaves with tips divided into three parts; small pink bell-shaped flowers borne in pairs on a tall stalk; fruit a capsule
HABITAT: boreal and coastal forests with an open canopy that allows light to reach the forest floor
FOODS: makes its own
EATEN BY: moth larvae, leaf hoppers, true bugs, deer, voles, sparrows, grouse
SYMBIOSES: needs mycorrhizal fungi to help it get soil nutrients; depends upon insects (???) to pollinate its flowers

Fireweed

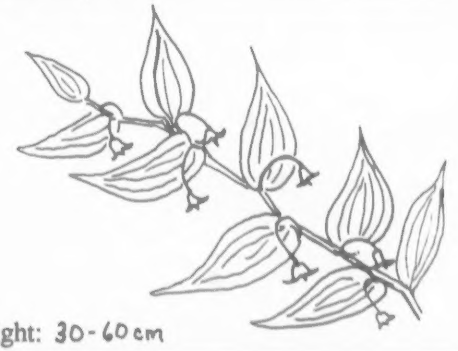


Height: 50-100cm

Fireweed *Epilobium spp.* **Plant**

TRAITS: groundcover plant; long narrow leaves on a tall stalk; many reddish purple flowers along top of stem; cottony seeds
HABITAT: disturbed soils; forests with open canopies that allow plenty of sunlight to reach the forest floor
FOODS: makes its own
EATEN BY: moth larvae, aphids, gall aphids, certain flies, true bugs, leaf hoppers, slugs, redpolls, sparrows, moose, hares, bears
SYMBIOSES: depends upon insects (such as bumblebees, hornets, and butterflies) to carry its pollen

Twisted Stalk

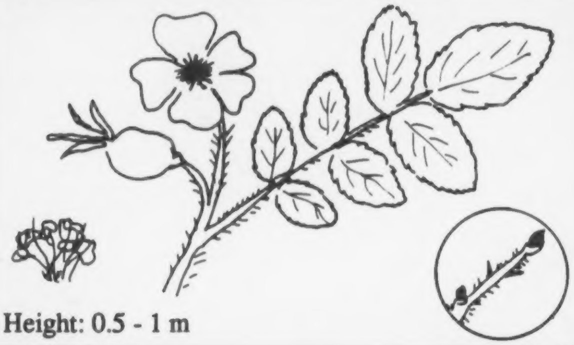


Height: 30-60cm

Twisted Stalk *Streptopus spp* **Plant**

TRAITS: ground cover plant; long leaves emerging from stem on alternate sides; stem changes angle of growth between leaves to form a stairstep shape; pink bell-like flowers borne beneath leaves; orange to dark red berries
HABITAT: coastal forest sites with open canopies
FOODS: makes its own
EATEN BY: moth and butterfly larvae, leaf hoppers, true bugs, aphids, other insects?? slugs, snails, mites, grouse, pine grosbeaks, voles, moose, hares, bears
SYMBIOSES: depends upon insects (butterflies, ??) to carry its pollen; depends upon mycorrhizal fungi to help it obtain nutrients from the soil

Wild Rose



Height: 0.5 - 1 m

Wild Rose *Rosa spp.* **Plant**

TRAITS: shrub; 5-9 cm leaves made up of 3- 9 leaflets emerge from the stems on alternate sides; stems covered with small thorns; large flowers with pink petals; red fruit topped by dead flower parts

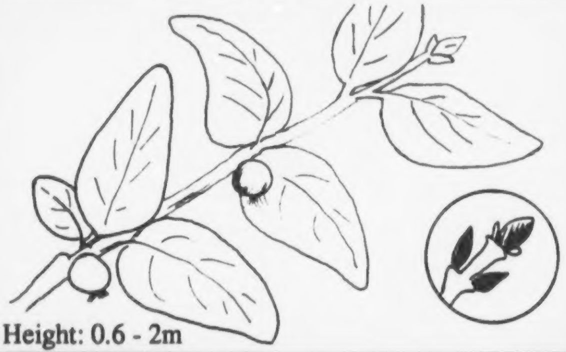
HABITAT: shaded understory of mature boreal forest, in old burn sites, tall shrub thickets, and along beaches; different species occur in the boreal and coastal forests

FOODS: makes its own

EATEN BY: moth larvae, aphids, pine grosbeaks, ruffed and sharp-tailed grouse, thrushes, hares, mice.

SYMBIOSES: depends upon certain mycorrhizal fungi to help it obtain nutrients from the soil; depends upon insects to carry its pollen

Soapberry



Height: 0.6 - 2m

Soapberry *Sheperdia canadensis* **Plant**

TRAITS: shrub; 1.2-5 cm oval leaves borne in pairs along the stem (opposite), smooth along edges; undersides of leaves covered with reddish-brown hairs; male and female flowers on separate plants; small yellow flowers emerge before leaves in spring; red to yellow berries

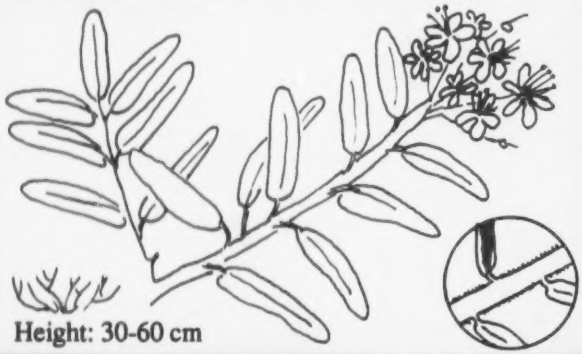
HABITAT: mature boreal forest and early stages of primary succession in coastal forest

FOODS: makes its own

EATEN BY: bears, grosbeaks, waxwings, grouse, insects such as aphids & larval moths and butterflies

SYMBIOSES: depends upon certain mycorrhizal fungi to help it obtain nutrients from the soil

Labrador Tea



Height: 30-60 cm

Labrador Tea *Ledum spp.* **Plant**

TRAITS: shrub; 8-50 mm long, narrow leaves are thick, rolled under on sides, and with reddish-brown, hairy undersides; many sweet-smelling white flowers borne in clusters at ends of twigs; fruit a capsule that opens at bottom

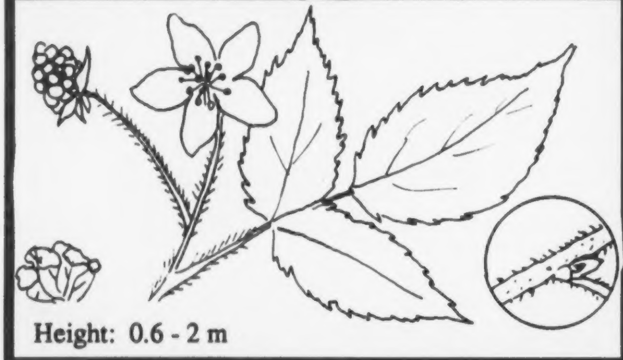
HABITAT: poorly drained soils, muskegs, old forests

FOODS: makes its own

EATEN BY: moth larvae, aphids, true bugs, leaf hoppers, snowshoe hares,

SYMBIOSES: needs mycorrhizal fungi to obtain some soil minerals; depends upon certain insects to carry its pollen

Raspberry and Salmonberry



Height: 0.6 - 2 m

Raspberry and Salmonberry *Rubus spp.* **Plant**

TRAITS: shrub, leaves made up of 3 leaflets, toothed along edges; showy white or pink flower; yellow to red fruit of many small seeds encased in fleshy coats

HABITAT: moist, cool climate; coastal forest

FOODS: makes its own

EATEN BY: aphids, true bugs, leaf hoppers, moth larvae, slugs, grouse, grosbeaks, jays, waxwings, thrushes, crows, sparrows; voles, deer mice, deer, moose, bears, hares, foxes, marten

SYMBIOSES: needs certain mycorrhizal fungi to help it obtain nutrients from the soil; these plants depend upon certain insects to carry their pollen

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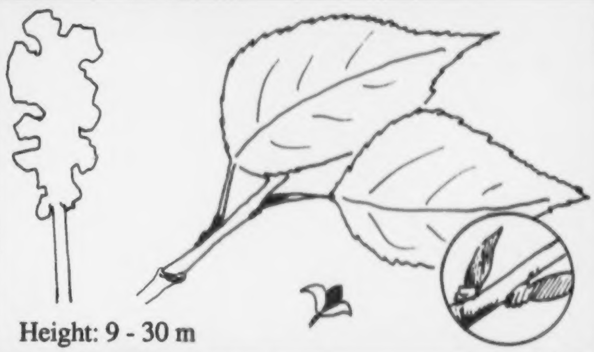
Balsam Poplar

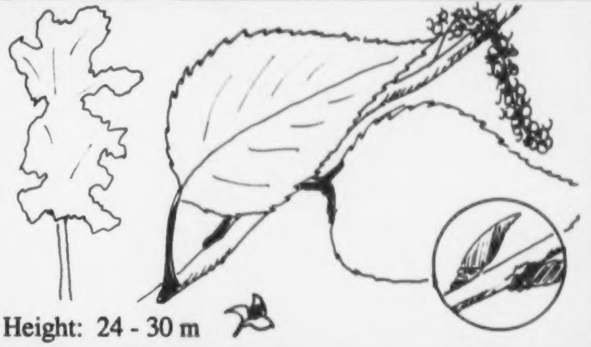


Height: 9 - 30 m

Balsam Poplar *Populus balsamifera* **Plant**

TRAITS: hardwood; spade-shaped leaves with small, rounded teeth; gray bark with deep furrows; male and female flowers on different trees; long, egg-shaped seed capsules borne in 15 cm long catkin; tiny, cottony seeds
HABITAT: well-drained soils in boreal forest
FOODS: makes its own
PREDATORS: aphids, gall-making aphids, moth larvae, sawflies, true bugs, leaf hoppers, moose, snowshoe hares, pine grosbeaks
SYMBIOSES: depends upon mycorrhizal fungi to help it obtain nutrients from the soil; parasitized by gall-making aphids

Black Cottonwood

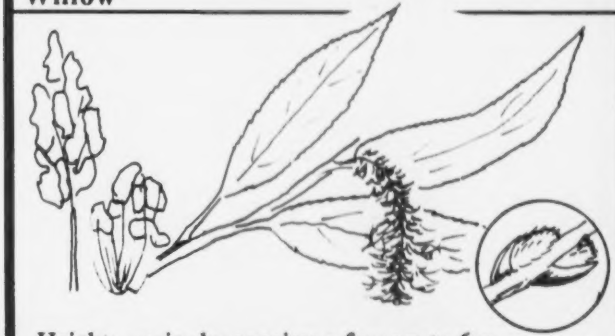


Height: 24 - 30 m

Black Cottonwood *Populus trichocarpa* **Plant**

TRAITS: hardwood; spade-shaped leaves with small rounded teeth; bark gray with deep furrows when full-grown; male and female flowers on different trees; round, 3-parted seed capsules borned in 15 cm long catkins; tiny cottony seeds
HABITAT: river bottoms in coastal forest
FOODS: makes its own
PREDATORS: moth larvae, aphids, gall-making aphids, leaf hoppers, true bugs, blue grouse, pine grosbeaks
SYMBIOSES: needs mycorrhizal fungi to help it get soil nutrients; parasitized by certain rusts, rots, shelf fungi and gall-making aphids

Willow

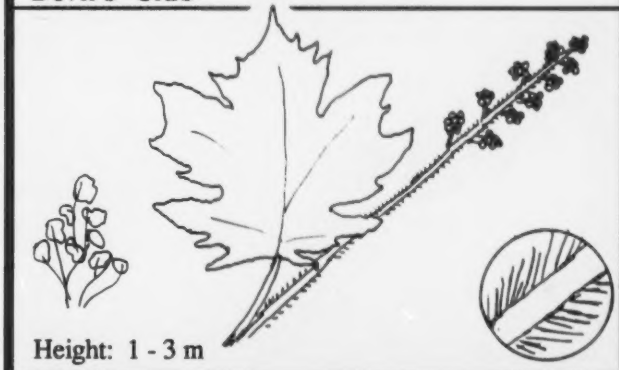


Height: varies by species; a few cm to 6 m

Willow *Salix spp.* **Plant**

TRAITS: hardwood tree or shrub; leaves variable in shape; small teeth if any along the leaf edges; male and female flowers in soft, fuzzy catkins; seeds cottony
HABITAT: varies by species
FOODS: makes its own
EATEN BY: moth larvae, aphids, gall-making aphids, certain flies, sawfly wasps, true bugs, leaf hoppers, moose, hares, pine grosbeaks,
SYMBIOSES: depends upon mycorrhizal fungi to help it obtain nutrients from the soil; parasitized by certain shelf fungi, rusts, and rots; certain gall-making aphids, sawfly wasps, mites, and flies cause galls

Devil's Club

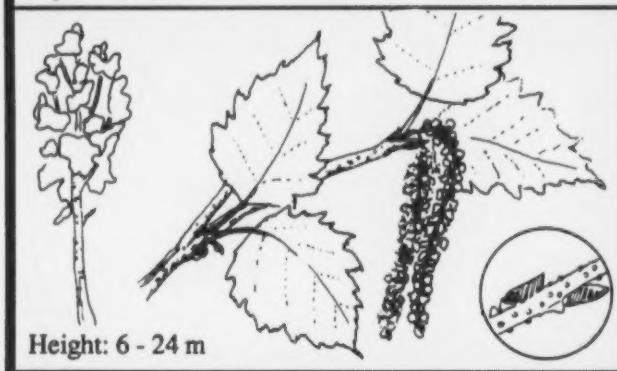


Height: 1 - 3 m

Devil's Club *Oplopanax horridus* **Plant**

TRAITS: large leaves, spine covered stems and leaves, large cluster of flowers; red berry fruit
HABITAT: coastal forest; old growth stands and clearings
FOODS: makes its own
EATEN BY: deer, red squirrels, leaf hoppers, true bugs
SYMBIOSES: likely depends upon mycorrhizal fungi to help it obtain nutrients from the soil.

Paper Birch

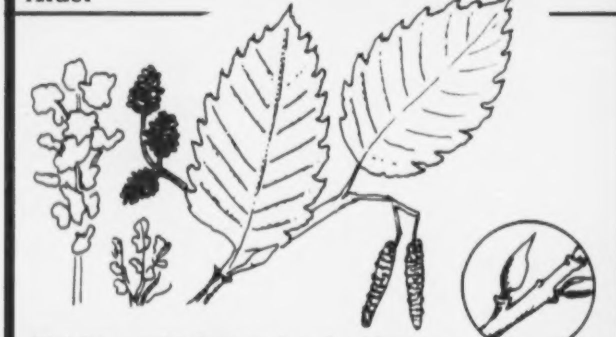


Height: 6 - 24 m

Paper Birch *Betula papyrifera* **Plant**

TRAITS: hardwood, 4-9 cm long leaves are rounded at the base with a sharp tip (ovate), and with tooths along the edges; bark is white, smooth, and separates into papery strips; male and female flowers on the same twig; seeds borne in 2.5-5 cm cone-like fruit
HABITAT: boreal forests, all slopes; grows best on sites without permafrost
FOODS: makes its own
EATEN BY: moth larvae, aphids, metallic wood borers pine grosbeaks, redpolls, ruffed grouse, moose, hares
SYMBIOSES: depends upon certain mycorrhizal fungi to help it obtain nutrients from the soil; some shelf fungi, rots, and blights are parasites

Alder

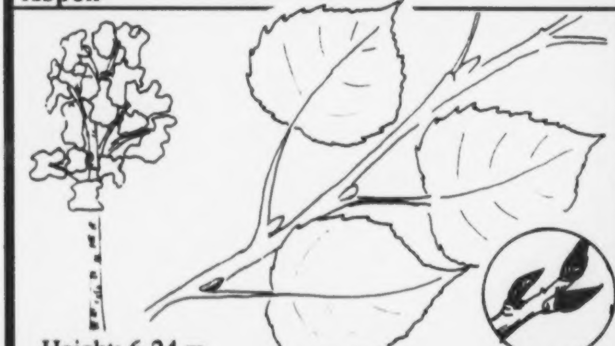


Height: varies by species; 1 - 12 m

Alder *Alnus spp.* **Plant**

TRAITS: hardwood tree or shrub; smooth gray bark with horizontal lines; toothed, sharp-pointed leaves; male flowers in long catkins, female catkins to 12 mm long; seeds borne in cone-like fruits which hang on the tree in clusters of 3-9
HABITAT: varies by species; common in early successional stages and in mature forests
FOODS: makes its own
EATEN BY: moth larvae, gall-making aphids, true bugs, leaf hoppers, redpolls
SYMBIOSES: certain nitrogen-fixing bacteria live in the roots of this plant; they help the plant obtain nitrogen in exchange for sugars made by the plant

Aspen

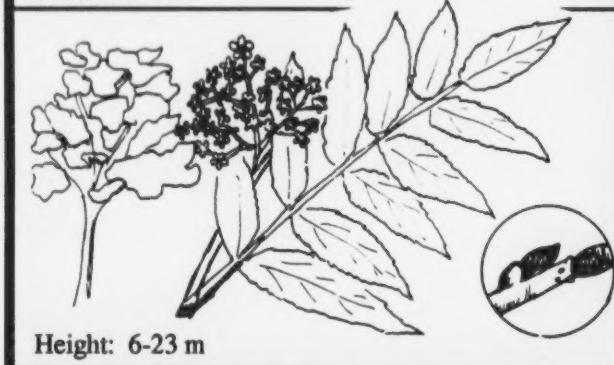


Height: 6-24 m

Aspen *Populus tremuloides* **Plant**

TRAITS: hardwood; round leaves sharply pointed at tip, small rounded tooths along edges; bark whitish or greenish gray with black scars and knots; male and female flowers on different trees; both borne in long catkins; cottony seeds
HABITAT: well-drained soil, on warm slopes
FOODS: makes its own
EATEN BY: moth larvae, aphids, gall-making aphids, true bugs, leaf hoppers, mites, pine grosbeaks, ruffed grouse, moose, snowshoe hares
SYMBIOSES: Parasitized by certain root rots, shelf fungi, mites, and microscopic organisms; aspen need mycorrhizal fungi to obtain some soil minerals

Mountain Ash



Height: 6-23 m

Mountain Ash *Sorbus sitxhensis* **Plant**

TRAITS: hardwood; 10-20 cm leaves are made up of 9-11 leaflets, each of which is oblong, and toothed; gray, smooth bark; showy flowers borne in large clusters; red berries
HABITAT: moist, cool climate; coastal forest
FOODS: makes its own
EATEN BY: aphids, true bugs, leaf hoppers, moth larvae, berries are eaten by pine grosbeaks, waxwings, thrushes, jays
SYMBIOSES: needs certain mycorrhizal fungi to help it obtain nutrients from the soil; parasitized by certain rots and blights, as well as by some monerans and protists

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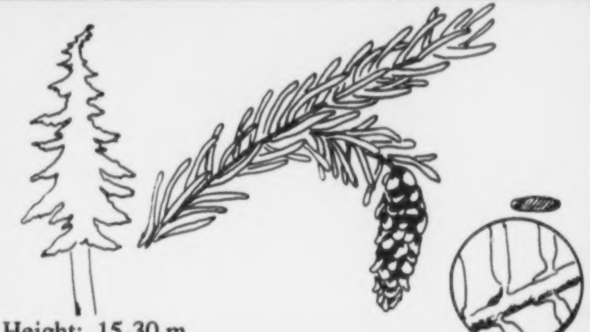
Mountain Hemlock

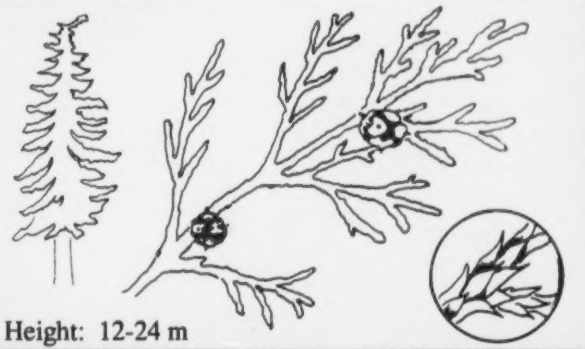


Height: 15-30 m

Mountain Hemlock *Tsuga heterophylla* **Plant**

TRAITS: conifer; 6-25 mm rounded, blunt needles; fine hair on twigs, gray to dark brown bark; 25-60 mm long, thin-scaled cones hang down
HABITAT: wet, moderate climates, on well-drained and poorly drained sites from sea level to 1067 m
FOODS: makes its own food
EATEN BY: red squirrels, crossbills, porcupines, larvae of bark and longhorn beetles, certain moths and flies, sawflies
SYMBIOSES: depends upon certain mycorrhizal fungi to help it obtain nutrients from the soil; some shelf fungi, rots, and blights, and dwarf mistletoe (a plant) are parasites

Alaska-cedar

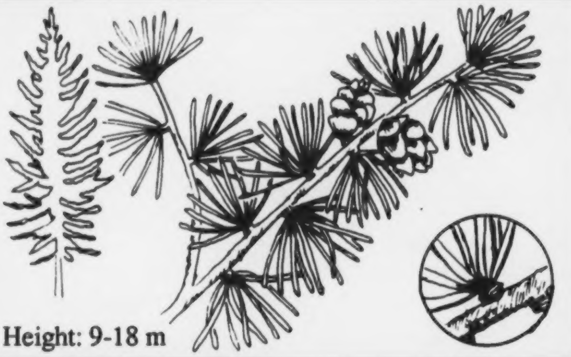


Height: 12-24 m

Alaska-Cedar *Chamaecyparis nootkatensis* **Plant**

TRAITS: conifer; 1.5-3 mm scale-like leaves; sprays of leaves flattened; drooping branches; bark gray to brown with shreds and fissures; 12 mm round cones, of 4-6 scales, each with a pointed knob in its center
HABITAT: wet, cool climate; sea level to high elevations on most soil types
FOODS: makes its own
EATEN BY: wood-boring insects, aphids, other herbivorous insects,
SYMBIOSES: unknown

Tamarack

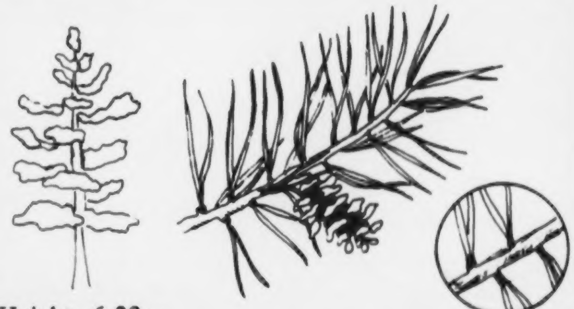


Height: 9-18 m

Tamarack *Larix laricina* **Plant**

TRAITS: conifer; sheds its leaves in fall; 10-25 mm needle-like leaves borne in clusters of 12-20; twigs hairless; dark gray thin bark; 10-15 mm cones made up of about 20 finely toothed scales
HABITAT: moist to wet soils in dry climate
FOODS: makes its own
EATEN BY: squirrels, wood-boring insects, aphids seed-eating birds (sparrows, redpolls)
SYMBIOSES: parasitized by certain root rots, shelf fungi, and microscopic organisms; the yellow-pored bolete mushroom grows only with tamaracks; tamaracks depend on certain mycorrhizal fungi to help them obtain minerals from the soil

Lodgepole Pine

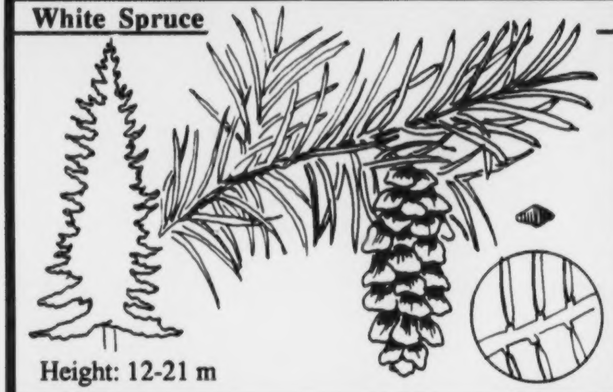


Height: 6-23 m

Lodgepole Pine *Pinus contorta* **Plant**

TRAITS: conifer; 25-60 mm needles borne 2 in a bundle, stiff and often twisted; orange to brown twigs; 3-5 cm egg-shaped cones with sharply-tipped scales
HABITAT: mainly poorly drained sites and muskegs of coastal forest
FOODS: makes its own
EATEN BY: wood-boring insects, aphids, and other insects
SYMBIOSES: needs certain mycorrhizal fungi to help it obtain nutrients from the soil; parasitized by rots, blights, and shelf fungi, as well as some microscopic organisms

White Spruce



Height: 12-21 m

White Spruce *Picea glauca* **Plant**

TRAITS: conifer tree; 4-angled, sharply-pointed 12-20 mm long needles with white lines on all sides; hairless twigs, thin gray bark; 30-60 mm cones with soft scales fall off the tree in fall

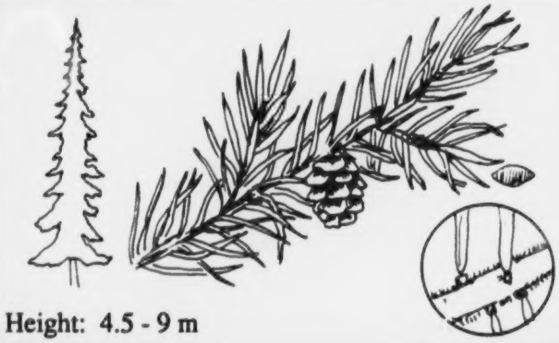
HABITAT: well-drained soils in boreal forest

FOODS: makes its own

EATEN BY: spruce grouse, porcupines, crossbills, red squirrels, bark and longhorn beetles, horntails, certain moths and flies, spruce aphids, carpenter ants

SYMBIOSES: Depends upon mycorrhizal fungi, especially truffles, to help it obtain nutrients from the soil. A rust fungi parasite causes witches brooms. Parasitized by spruce aphids which cause galls.

Black Spruce



Height: 4.5 - 9 m

Black Spruce *Picea mariana* **Plant**

TRAITS: conifer tree with 4-angled, pointed needles, 6-15 mm long, white lines on all 4 sides; tiny hairs cover twigs, thin gray to black bark; 15-30 cm round, stiff-scaled cones stay on the tree for years and are opened by fire or years of drying in sun

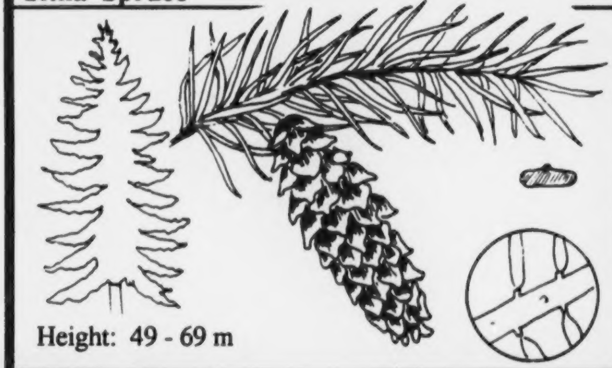
HABITAT: grows mainly in wet soils and on north-facing slopes in dry climates where fires occur

FOODS: makes its own

EATEN BY: red squirrels, porcupines, bark and longhorn beetles, horntails, certain moths and flies, spruce aphids, carpenter ants.

SYMBIOSES: needs mycorrhizal fungi to help it get soil nutrients; parasitized by rusts, rots and shelf fungi

Sitka Spruce



Height: 49 - 69 m

Sitka Spruce *Picea sitchensis* **Plant**

TRAITS: conifer; 15-25 mm, sharply-pointed needles, flattened with slight keel; hairless twigs, gray to purplish brown bark; 5-9 cm cones with stiff, long scales fall off every year

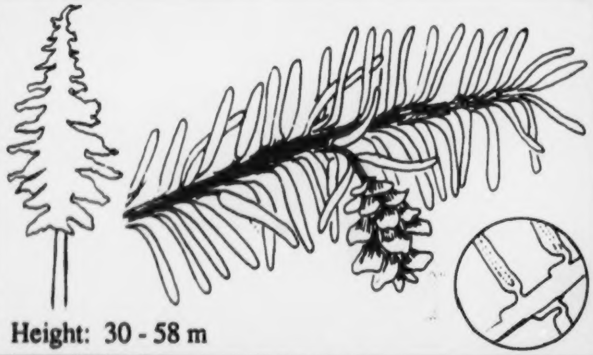
HABITAT: grows best on well-drained soils in wet, moderate climate

FOODS: makes its own

EATEN BY: red squirrels, crossbills, porcupines, deer mice, bark beetles, horntails, certain moths and flies, spruce aphids, carpenter ants

SYMBIOSES: depends upon mycorrhizal fungi to help it obtain nutrients from the soil; parasitized by certain shelf fungi, rusts, rots, and spruce aphids

Western Hemlock



Height: 30 - 58 m

Western Hemlock *Tsuga heterophylla* **Plant**

TRAITS: conifer; 6-22 mm needles arranged in 2 rows along twig, 2 white lines on lower surface; hairy twigs; reddish-gray bark with red inner bark; cones 15-25 mm

HABITAT: coastal forest; grows best on deep, well-drained soil at low elevations; but also grows well on shallow soil if site is moist enough; can grow in shade

FOODS: makes its own

EATEN BY: deer, red squirrel, blue grouse, crossbills, pine siskins, bark beetles, horntails, certain moths and flies, spruce aphids, sawflies

SYMBIOSES: parasitized by certain shelf fungi, rots, blights, and dwarf mistletoe (a plant); depends upon mycorrhizal fungi to help it obtain soil nutrients

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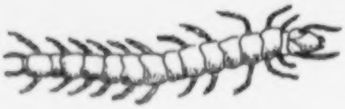
Centipedes

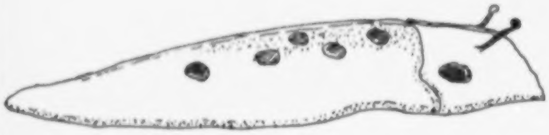


Length: 2-50 mm

Centipedes **Animal**

TRAITS: a small worm-like animal with only one pair of legs on each of its body segments, all have poison claws for capturing prey
HABITAT: in soil and humus, or beneath stones, bark, or logs
FOODS: invertebrates that live in the soil, including springtails, bristletails, ground beetles, fly larvae, flea larvae, mites, worms, snails
EATEN BY: thrushes, winter wrens
SYMBIOSES: unknown

Slugs

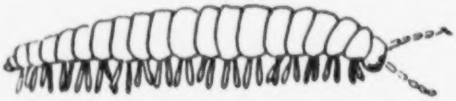


Length: 1 - 10 cm

Slugs **Animal**

TRAITS: a snail-like animal without a shell; two pairs of antennae, eyes are located on the tips of one pair.
HABITAT: in moist or wet forests, mainly in coastal forest in Alaska; larvae live on rotten leaves and logs
FOODS: leaves of plants, including skunk cabbage, salmonberry, and others.
EATEN BY: certain ground beetles
SYMBIOSES: unknown

Millipedes

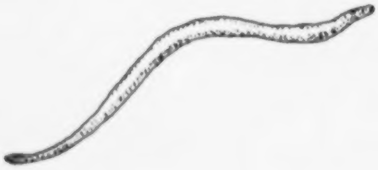


Length: 2-50 mm

Millipedes **Animal**

TRAITS: slender-bodied worm-like animals with distinct segments along the body, two leg-like structures on each segment; some species have poison glands that secrete hydrogen
cyanide
HABITAT: under rocks, logs, and in rotten leaves, wood or soil; they occur only in coastal forest in Alaska
FOODS: varies by species; most eat decaying plants and fungi; a few eat centipedes, worms, or insects
EATEN BY: thrushes, sparrows, wrens, ground beetles
SYMBIOSES: unknown

Roundworms

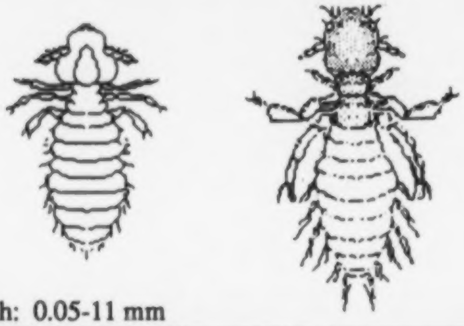


Length: microscopic to 1mm

Roundworms **Animal**

TRAITS: slender worms tapered at both ends and without any segments
HABITAT: various species live in the soil, on mosses, lichens,or leaves, or on waste materials; many live in water
FOODS: varies by species; some feed on algae and fungi, or suck out fluids from plants; others prey on tiny animals; some eat waste materials
EATEN BY: centipedes
SYMBIOSES: these worms often hitch rides to new areas on the legs of flies, beetles, birds, or mammals; many nematodes are parasites of plants or animals.

Lice

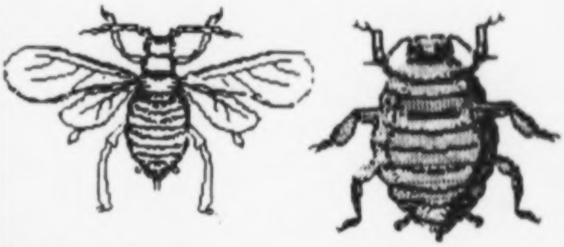


Length: 0.05-11 mm

Lice **Animal**

TRAITS: small, wingless insects with sucking or chewing mouthparts
HABITAT: found on the skin, fur, or feathers of birds or mammals
FOODS: varies by species; some suck blood of mammals or birds; others eat skin, feathers, or fur
EATEN BY: unknown
SYMBIOSES: all lice are parasites of birds or mammals; some blood-sucking lice carry microscopic organisms that cause diseases of mammals and birds

Aphids or Plant Lice

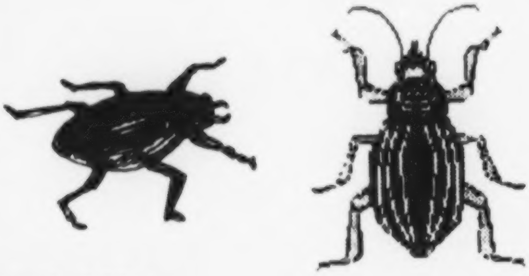


Length: 1-6 mm

Aphids or Plant Lice **Animal**

TRAITS: pear-shaped insects; winged and wingless forms in the same species; most have 2 tubes (called cornicles) on the top of their abdomen
HABITAT: leaves and stems of plants
FOODS: sap of plants; they cause plant leaves to wilt, curl, and turn yellow
EATEN BY: ants, wasps, warblers, chickadees, kinglets, wrens, sparrows
SYMBIOSES: aphids produce a secretion, called honeydew; in order to obtain this honeydew, certain ants protect and tend aphids; some aphids carry microscopic organisms that cause plant diseases; some aphids cause plants to form galls

Ground Beetles

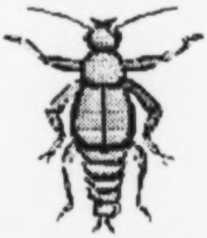


Length: 5-35 mm

Ground Beetles **Animal**

TRAITS: dark, flattened insects with front wings thickened and shiny with grooves running from front to back; long legs, large mouthparts.
HABITAT: in most habitats on land; most are active only at night, and hide during the day under logs, rocks, or leaf litter.
FOODS: varies by species; some adults feed on dead animal remains; others prey on insects, (such as caterpillars), or on slugs and snails
EATEN BY: jays, thrushes, wrens, sparrows, centipedes
SYMBIOSES: unknown

Rove Beetles



Length: 3-15 mm

Rove Beetles **Animal**

TRAITS: dark, flattened insects with short, thick front wings, long slender body, and a habit of holding their abdomen up over their back when running away; some have large mouthparts that cross at the tips; may be covered by hairs
HABITAT: soil in forests and other habitats
FOODS: varies by species; most adults feed on dead animal or plant remains; others prey on insects, such as ants
EATEN BY: thrushes, jays, wrens, sparrows, centipedes, ground beetles, mice, shrews
SYMBIOSES: some are parasites of other insects.

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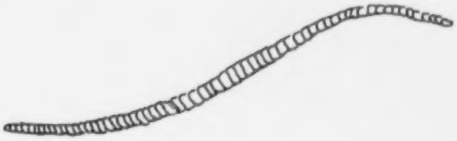
Segmented Worms

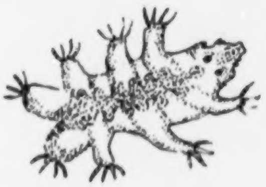


Length: 2-7 cm

Segmented Worms **Animal**

TRAITS: slender-bodied worms with distinct segments along the body
HABITAT: in many habitats; in the forest they live in moist soil and decaying vegetation; (typical earth worms are found only in coastal forest, but other segmented worms occur in boreal forest)
FOODS: varies by species; those that live in soil eat decaying vegetation, algae, or other invertebrate animals
EATEN BY: thrushes, centipedes, ground beetles
SYMBIOSIS: some segmented worms, called leeches, are parasites on other animals, including mammals, fish, birds, insects, snails, and worms.

Tardigrades

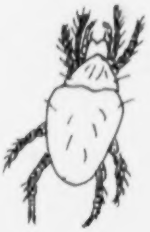


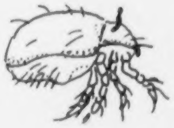
Length: microscopic to 0.05 mm

Tardigrades **Animal**

TRAITS: tiny to microscopic in size; chubby with 4 pairs of short legs with 4 to 8 claws on each leg; can survive for years in an inactive state when conditions are adverse
HABITAT: lives in the water film around mosses and lichens
FOODS: fluids from inside the cells of mosses and lichens
EATEN BY: roundworms, centipedes
SYMBIOSES: unknown

Mites



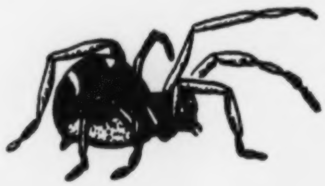


Length: microscopic to 2 mm

Mites **Animal**

TRAITS: tiny to microscopic animals, with 8 legs and a pear-shaped body
HABITAT: extremely abundant in moss, rotten leaves, humus, and soil of forests
FOODS: varies by species; many prey on roundworms, other mites, and insect larvae (such as springtails, bristletails, rove beetles, flies); others feed on plants, or on dead plants and animals
EATEN BY: centipedes, some ground beetles, lady beetles, winter wrens, thrushes, sparrows
SYMBIOSES: some detritivore mites ride on the backs of carrion beetles; some mites parasitize other animals

Spiders

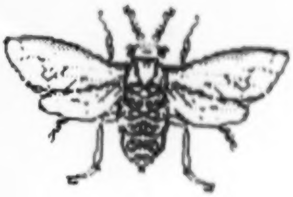


Length: 0.05 - 10 mm

Spiders **Animal**

TRAITS: small animals with 8 legs, the body appears divided into a large abdomen and a small head with large fangs
HABITAT: in and on soil or leaf litter, on plants, in rotten logs
FOODS: all spiders are predators that feed on small animals, mainly insects such as aphids, flies, rove beetles, springtails, bristletails, and others
EATEN BY: insect-eating birds, such as thrushes, winter wrens,
SYMBIOSES: unknown

Sawfly Wasps

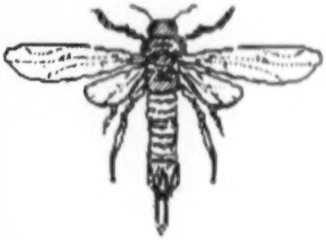


Length: 5-15 mm

Sawfly Wasps **Animal**

TRAITS: insects with 4 clear wings, hind wings smaller than forewings; long antennae, pointed abdomen
HABITAT: adults use a variety of habitats, but larvae usually live only on a particular species of plant; larvae overwinter in leaf litter.
FOODS: mainly leaves of conifers, hardwoods, and other plants; larvae of some species are leaf miners. Some species eat nectar or pollen, and some eat other small insects.
EATEN BY: flycatchers, swallows, certain wasps
SYMBIOSES: parasitized by wasps; some sawflies cause willow to form galls

Horntails

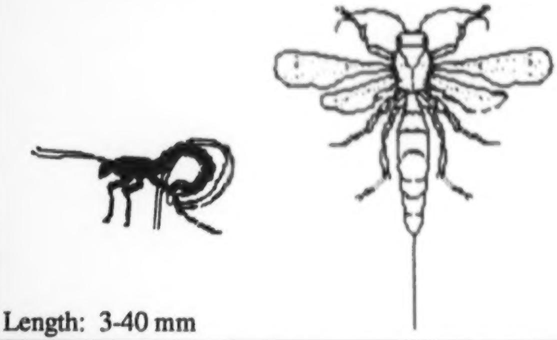


Length: 20-50 mm

Horntails **Animal**

TRAITS: insect with 4 clear wings, hind wings smaller than forewings; long cylinder-shaped abdomen with a spine-like projection at the tail end which is used for egg-laying; this insect does not sting.
HABITAT: forests; larvae live in wood of living or dead trees.
FOODS: larvae eat wood
EATEN BY: woodpeckers, creepers, nuthatches, icheneumon wasps
SYMBIOSES: some are parasitized by ichneumon wasps

Ichneumon Wasps

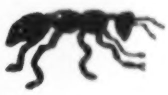


Length: 3-40 mm

Ichneumon Wasps **Animal**

TRAITS: insects with long narrow bodies, 4 clear wings, of which the hind pair is smaller; antennae that are at least half as long as the body; some have a long narrow tail-like structure for egg-laying
HABITAT: any habitat where there are host insects available
FOODS: these wasps lay their eggs inside larval sawflies, horntails, butterflies, moths, and spiders; when the eggs hatch, the larvae eat the host.
EATEN BY: flycatchers, swallows, thrushes, warblers, chickadees
SYMBIOSES: These wasps are important parasites of immature insects.

Ants

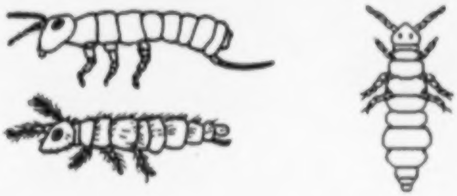


Length: 1-13 mm

Ants **Animal**

TRAITS: body clearly divided into 3 segments by narrow constrictions; last segment forms a pointed end; many secrete formic acid as a defense; only certain kinds of adults have wings
HABITAT: in colonies in the ground or wood
FOODS: varies between species. Some feed on flower nectar, plant juices, or aphid honeydew. Others feed on seeds, leaves, or dead organisms, and some are predators on other insects.
EATEN BY: flickers, wrens, thrushes, sparrows
SYMBIOSES: Some protect aphids from predators, then feed on the sugary secretion (honeydew) the aphids produce. Some carry pollen between plants.

Springtails

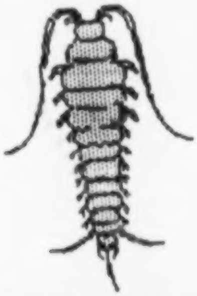


Length: up to 6 mm

Springtails **Animal**

TRAITS: small wingless insects with chewing mouthparts, a tube-like part on its front underside (called a collophore) and a forked spring-like part (called a furcula) on its rear underside. A springtail can spring 100 mm by using its furcula
HABITAT: lives in soil, litter, decaying logs, and moss; a few species live in trees.
FOODS: decaying materials; algae, lichens, pollen, and fungal spores.
EATEN BY: centipedes, ground beetles, shrews, thrushes
SYMBIOSES: none known.

Bristletails

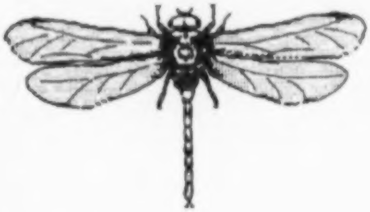


Length: 8-13 mm

Bristletails **Animal**

TRAITS: wingless insects with 3 tail-like parts and long antennae; often covered with scales; chewing mouthparts; may run quickly or jump
HABITAT: damp, moist litter and soil of forests and meadows; under bark of logs or under rocks
FOODS: decaying leaves
EATEN BY: centipedes, shrews, thrushes, ground beetles
SYMBIOSES: none known.

Dragonflies

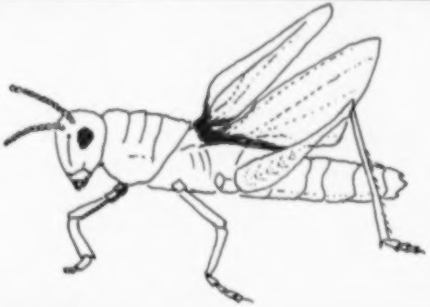


Length: 10-60 mm

Dragonflies **Animal**

TRAITS: insects with adults of brightly colored bodies, large eyes, long narrow abdomen, and 2 pairs of large wings; their wings are held out at right angles to their body; hind wings broader at the base than forewings.
HABITAT: larvae live on aquatic plants or on the bottom of streams or ponds; adults live near water in many habitats, including forests
FOODS: larvae prey on aquatic insects, tadpoles, and small fish; adults eat small flying insects including mosquitos, moths, lacewings, beetles, and others.
EATEN BY: insect-eating birds such as swallows
SYMBIOSES: none known.

Grasshoppers

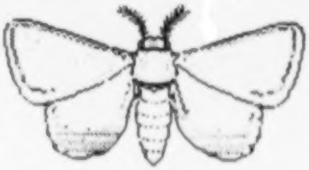


Length: 15-40 mm

Grasshoppers **Animal**

TRAITS: insects with large hind legs for jumping; most have thickened and narrow front wings and hind wings that are clear and large; all have chewing mouthparts.
HABITAT: most habitats with herbaceous plants and grasses
FOODS: leaves, stems, and other parts of plants.
EATEN BY: American kestrels and other insect-eating birds
SYMBIOSES: none known

Moths

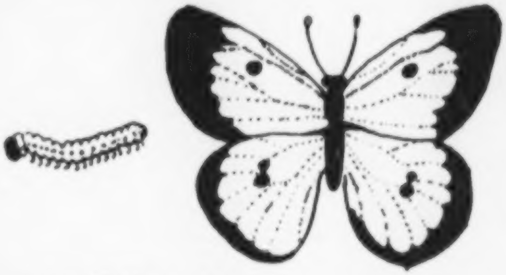


Length: 6-150 mm

Moths **Animal**

TRAITS: insects with 4 large wings with powder-like scales; large eyes, long antennae that are either feather-like or tapered at ends; most have tube-like mouths that coil up when not in use. Larvae spin cocoons; some larvae make tents of silk threads.
HABITAT: adults use a variety of habitats; most larvae can only live on a particular species of plant
FOODS: adults feed mainly on flower nectar; most larvae feed on plant leaves, fruit, stems and roots
EATEN BY: bats, shrews, ground beetles,warblers, flycatchers, swallows, chickadees, kinglets
SYMBIOSES: adults pollinate flowers; larvae are parasitized by ichneumon wasps

Butterflies

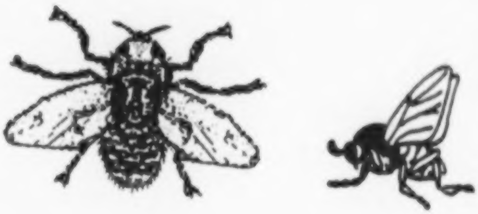


Length: 6-150 mm ??

Butterflies **Animal**

TRAITS: adults have 4 large wings with powder like scales, large compound eyes, long antennae that have clubs at the tips, and tube-like mouths that coil up when not in use. Adults are active in the daytime; larvae form a chrysalis for pupation
HABITAT: adults use a variety of habitats; most larvae can live only on a particular species of plant
FOODS: adults feed mainly on flower nectar; most larvae feed on plant leaves, fruit, stems, or roots
EATEN BY: insect-eating birds such as warblers, and flycatchers; ground beetles, wasps, dragonflies
SYMBIOSES: Adults pollinate flowers. Larvae are often parasitized by ichneumon wasps.

Blowflies

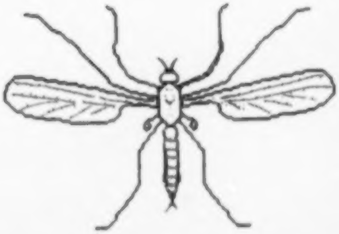


Length: 1-15 mm

Blow Flies **Animal**

TRAITS: insects with one pair of clear wings and a pair of small knobs (called halteres), large eyes, metallic blue or green backs
HABITAT: varies; mainly in the soil or on and in dead animals
FOODS: varies; liquids from decaying plants and animals, animal wastes or blood
EATEN BY: warblers, flycatchers, chickadees, and thrushes; shrews, carrion beetles, dragonflies, hornets, centipedes.
SYMBIOSES: Some blow flies are important as plan pollinators. Many flies transport microscopic organisms that cause diseases in animals

Craneflies

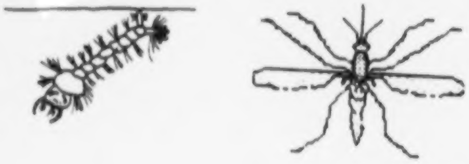


Length: 10-35 mm

Craneflies **Animal**

TRAITS: very long-legged insects that resemble huge mosquitos; they have one pair of clear wings and a small pair of knobs (called halteres) on the back
HABITAT: varies; larvae live in moist soil, and decaying plants in forests; a few live in the water;
FOODS:
EATEN BY: warblers, flycatchers, swallows, chickadees, thrushes, sparrows, shrews, carrion beetles, centipedes, hornets, dragonflies
SYMBIOSES: Some craneflies pollinate flowers

Mosquitos

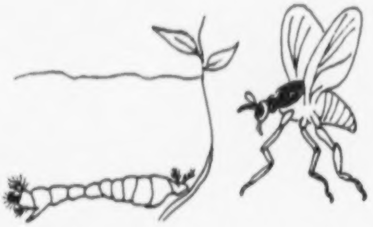


Length: 2-4.5 mm

Mosquitos **Animal**

TRAITS: small insects with long legs, one pair of clear wings and a pair of knobs, called halteres, on the back, piercing and sucking mouthparts form a tube; males have feather-like antennae
HABITAT: larvae live in the water; adults are found in most habitats including forests; males are often found in or near flowers
FOODS: larvae feed on algae, protozoans, and dead plants; adult males feed on flower nectar, while adult females suck the blood of animals
EATEN BY: bats, swallows, warblers, dragonflies
SYMBIOSES: males pollinate flowers; females carry microscopic organisms that cause diseases

Blackflies

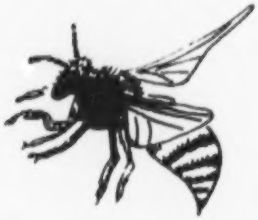


Length: 2-4 mm

Blackflies **Animal**

TRAITS: small dark insects with a humped back, one pair of clear wings, and a pair of knobs, called halteres, on the back; short legs and broad wings
HABITAT: wetlands, forests, tundra
FOODS: larvae live in the water and feed on algae, protozoans, and dead plant material; adults feed on flower nectar; female adults also suck blood from vertebrate animals
EATEN BY: bats, warblers, chickadees, flycatchers, swallows, mice, dragonflies
SYMBIOSES: some blackflies pollinate flowers; females carry microscopic, disease-causing organisms

Yellowjackets and Hornets

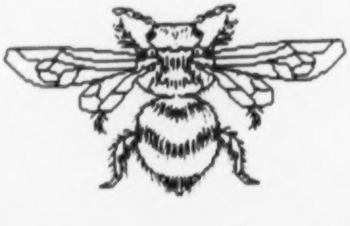


Length: 10-20 mm

Yellowjackets and Hornets **Animal**

TRAITS: insects with bright black and yellow or white markings; the third body segment is separated from the middle one by a narrow 'waist"; the tip of the abdomen is pointed and has a stinger
HABITAT: hornets build paper nests in the ground and in or on trees.
FOODS: adults feed on flower nectar, ripe fruit, and other insects; they feed their larvae insects, such as caterpillars and flies, meat from dead animals, and nectar.
EATEN BY: insect-eating birds such as flycatchers and swallows
SYMBIOSES: some hornets pollinate flowers

Bumblebees



Length: 8-23 mm

Bumblebees **Animal**

TRAITS: insects with 4 wings, hind wings much smaller than front ones; hairy body covered with black, and yellow or orange markings
HABITAT: any habitat with a variety of nectar-producing flowers; includes pioneer, tall shrub, and old forest habitats; nests in the ground
FOODS: nectar and pollen of flowering plants
EATEN BY: flycatchers, swallows, warblers
SYMBIOSES: bees are among the most important plant pollinators; some species eat the nectar and pollen, and pollinate, only one species of plant; mites often hitch rides on bees to reach new areas

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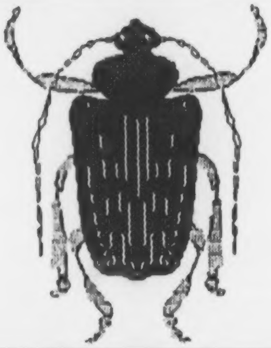
Longhorned Beetles

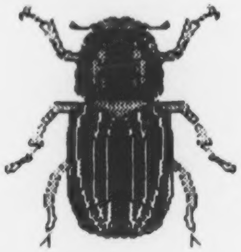


Length: 9-18 mm

Longhorned Beetles **Animal**

TRAITS: large insects with thick, dark front wings, antennae half as long as body or more
HABITAT: weakened, dying, dead or freshly cut or fallen trees; recent burns contain many dead trees, so longhorns are attracted to these sites; they are able to smell smoke and detect fires from 25 miles away;
FOOD: adults eat leaves and flowers; larvae eat wood
EATEN BY: woodpeckers, ichneumon wasp larvae
SYMBIOSES: these beetles depend upon microscopic organisms (monerans) that live in their digestive tracts to break down and digest wood so that the beetles can absorb the stored energy and minerals in it.

Bark Beetles

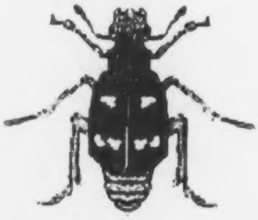


Length: usually 1-3 mm

Bark Beetles **Animal**

TRAITS: small, round-bodied insects with thickened front wings; small antennae with clubs on the tips
HABITAT: under tree bark
FOOD: varies by species; most eat the underside of tree bark or wood; others (ambrosia bark beetles) feed on fungi that grows in the tunnels they bore into wood
EATEN BY: woodpeckers, brown creepers, ichneumon wasp larvae
SYMBIOSES: most bark beetles need monerans to break down and digest wood; some species have these microscopic organisms living in their stomachs; ambrosia beetles carry spores of the fungi they eat; it grows only in holes bored into wood by these beetles

Carrion Beetles

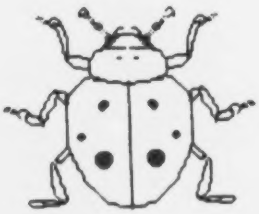


Length: 10-20 mm

Carrion Beetles **Animal**

TRAITS: large, round-bodied insect with thickened front wings, black with red, orange, or yellow markings, clubbed antennae
HABITAT: soil and litter of forests and other habitats
FOOD: they feed on dead animals, such as voles, and prey on other insects that feed on dead animals, such as fly larvae; the adult female lays her eggs and buries them with a dead animal.
EATEN BY: thrushes, shrews, mice, voles
SYMBIOSES: most carrion beetles have mites riding on their backs. These mites get a free ride to new food sources, but do not affect the beetle.

Lady Beetles

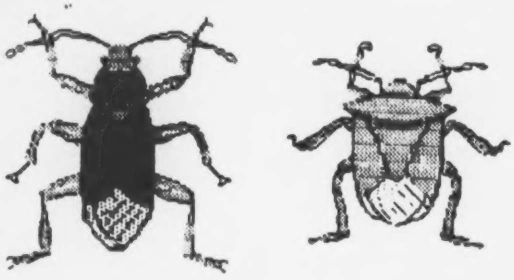


Length: 1-7 mm

Lady Beetles **Animal**

TRAITS: brightly colored insects with very round bodies, thickened front wings, usually with spots on them; larvae are usually dark with bands of color and covered with spines
HABITAT: on leaves and stems of plants in forests, shrub thickets, and meadows
FOOD: most adults and larvae prey on aphids and other small insects, and mites; a few species eat plant leaves
EATEN BY: warblers, chickadees, thrushes
SYMBIOSES: unknown

True Bugs

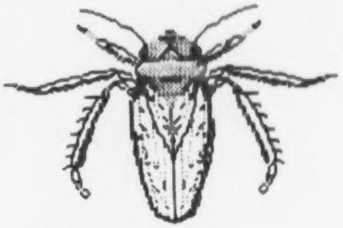


Length: 1-20 mm

True Bugs **Animal**

TRAITS: front wings thick, colored, and hardened near body, but thin and often clear at the tips; held flat over body; beak-like mouthparts at front of head
HABITAT: varies by species; some live only on the species of plant they eat, others are predatory and use various habitats.
FOODS: varies by species; plant sap or fruit juices; juice from fungi; fluids from insects or other animals, or juices from both plants and animals.
EATEN BY: many true bugs give off odors to repel predators; insect-eating animals, such as chickadees, thrushes,warblers, shrews, wasps, ground beetles
SYMBIOSES: unknown

Leafhoppers

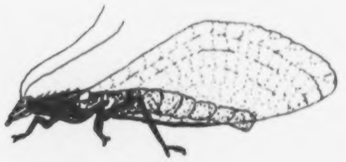


Length: up to 13 mm

Leafhoppers **Animal**

TRAITS: front pair of wings thin and clear, or only slightly colored; held roof-like over body; beak-like mouth comes out of the rear underside side of the head; 1 or more rows of spines on the hindlegs.
HABITAT: found on plants in forests and other habitats.
FOODS: sap of plants
EATEN BY: warblers, thrushes, chickadees, shrews, ground beetles, centipedes
SYMBIOSES: many leaf hoppers carry microscopic organisms that parasitize plants from one plant to another

Lacewings

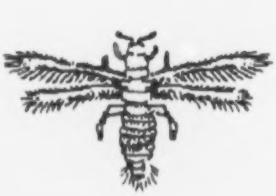


Length: 9-15 mm

Lacewings **Animal**

TRAITS: green or brown insects with large, clear wings with net-like veins, held tent-like over their body; small head with large eyes and chewing mouthparts, long antennae; some give off an unpleasant odor when handled
HABITAT: On leaves of trees and shrubs; eggs are attached to a leaf by a thread the female forms; larvae spin a cocoon
FOODS: Adults eat pollen, nectar and aphid honeydew; larvae prey on mites, aphids and other insects
EATEN BY: thrushes, warblers, chickadees, kinglets, hornets, dragonflies, bats, shrews
SYMBIOSES: unknown

Thrips

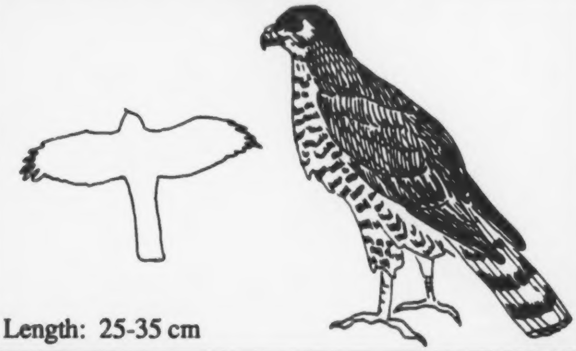


Length: 0.5- 5.0 mm

Thrips **Animal**

TRAITS: tiny winged or wingless long-bodied insects; if winged, they have four narrow wings with fringes of long hairs; antennae, and tube-like mouthparts
HABITAT: flowers, leaves of plants
FOODS: most eat flowers, leaves, buds, and fruits; a few eat fungal spores or mites and small insects
EATEN BY: warblers, chickadees, creepers, wrens, ants, hornets, ground beetles, lacewings
SYMBIOSES: some carry microscopic organisms that cause plant diseases.

Sharp-shinned Hawk

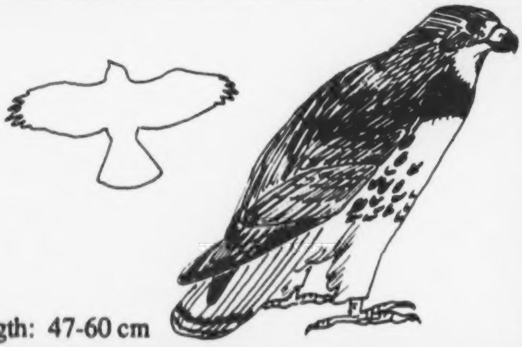


Length: 25-35 cm

Sharp-shinned Hawk Animal

TRAITS: medium-sized bird with long tail and rounded wings, sharp talons and hooked bill
HABITAT: mature and old mixed hardwood-conifer forests
FOODS: small birds, including chickadees, warblers, sparrows, thrushes, and woodpeckers
EATEN BY: eggs and young may be taken by squirrels
SYMBIOSES: All birds are parasitized by certain microscopic organisms, feather lice, and other invertebrate animals.

Red-tailed Hawk

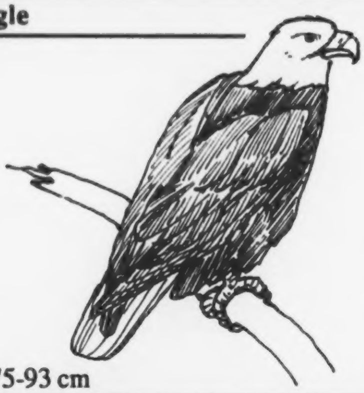


Length: 47-60 cm

Red-tailed Hawk Animal

TRAITS: large brown bird with rounded tail and wings; tail reddish, sharp talons and hooked bill
HABITAT: usually nests in old trees, sometimes on cliffs; feeds in open areas, including early successional stages, muskegs, and along rivers.
FOODS: voles, mice, snowshoe hares, squirrels, shrews, weasels, other small mammals
EATEN BY: eggs may be taken by ravens
SYMBIOSES: All birds are parasitized by certain microscopic organisms, feather lice and some other invertebrate animals.

Bald Eagle

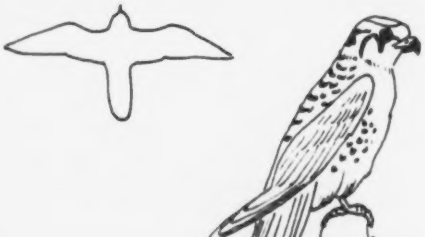


Length: 75-93 cm

Bald Eagle Animal

TRAITS: large brown bird with rounded tail and wings; sharp talons and hooked bill; adults have a white head and tail
HABITAT: old forests along rivers, lakes, and ocean; usually nests in large old trees, but feeds mainly near water; also nests on the ground or cliff ledges on islands where predators are absent
FOODS: primarily fish; herring, sand lance, salmon that are spawned out, and others; also dead animals such as deer, seals, birds, etc.
EATEN BY: no predators known
SYMBIOSES: All birds are parasitized by certain microscopic organisms, and feather lice.

American Kestrel

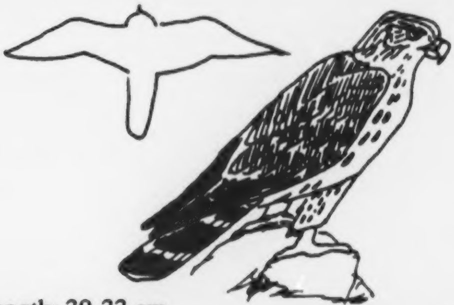


Length: 23-30 cm

American Kestrel Animal

TRAITS: medium-sized reddish-brown bird with long tail, pointed wings, sharply hooked bill
HABITAT: forest edges and openings, and early successional stages that include large, dead trees with holes for nesting
FOODS: large flying insects such as grasshoppers, dragonflies; small mammals and birds such as voles, mice, sparrows
EATEN BY: none known
SYMBIOSES: uses abandoned woodpecker holes for nesting (prefers flicker holes). All birds are parasitized by certain microscopic organisms, feather lice, and other invertebrate animals.

Merlin

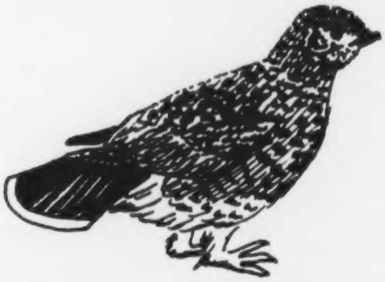


Length: 30-33 cm

Merlin **Animal**

TRAITS: medium-sized bird with long tail and sharply-pointed wings; sharp talons and hooked bill
HABITAT: open coastal and boreal forests; uses stick nests in spruce trees, or less commonly, nests on the ground.
FOODS: songbirds, including thrushes, juncos, swallows, waxwings, sparrows, woodpeckers, and warblers.
EATEN BY: squirrels and marten may eat eggs
SYMBIOSES: these small falcons often place their nests in abandoned magpie nests; all birds are parasitized by certain microscopic organisms, feather lice and other invertebrate animals.

Blue Grouse

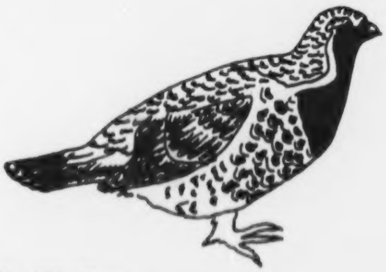


Length: 45-52.5 cm

Blue Grouse **Animal**

TRAITS: chicken-like bird with long black tail tipped in gray; female brown, male gray
HABITAT: coastal rain forest, including muskegs and alpine areas during summer.
FOODS: mainly leaves and shoots of groundcover plants, including herbs and ferns, also seeds and berries; insects, such as beetles, ants, and caterpillars are eaten at times
EATEN BY: great horned owls, goshawks, foxes, humans; eggs and young by weasels
SYMBIOSES: may transport seeds of some berry-producing plants; all birds are parasitized by certain microscopic organisms, and feather lice.

Spruce Grouse

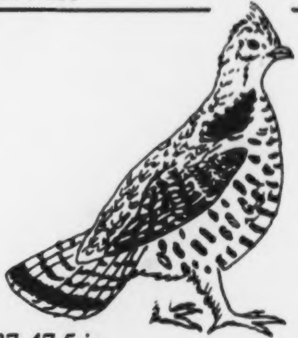


Length: 37-42 cm

Spruce Grouse **Animal**

TRAITS: chicken-like bird with rusty band at the tip of black tail; male has black chest, while female is mottled brown and white
HABITAT: coniferous and spruce-hardwood forests; seeks shelter in forest, but feeds in forest and in openings; requires a source of grit and gravel in fall.
FOODS: leaves, shoots, seeds, and berries of groundcover plants; eats mainly conifer needles in winter; chicks eat mainly insects
EATEN BY: goshawks, great horned owls, great gray owl, fox, lynx, weasels, humans
SYMBIOSES: may carry seeds of some plants.

Ruffed Grouse

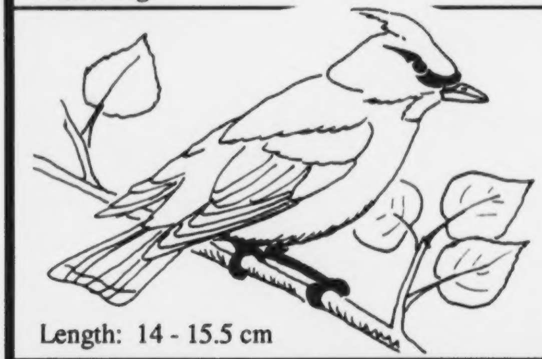


Length: 37-47.5 in

Ruffed Grouse **Animal**

TRAITS: chicken-like bird with a ruff of black feathers on sides of neck; dark band at edge of gray tail
HABITAT: hardwood forests, also thickets of willow and alder
FOODS: leaves, shoots, seeds and berries of trees, ground cover and understory plants; chicks eat mainly insects
EATEN BY: goshawks, great horned owls, great gray owls, foxes, lynx, humans
SYMBIOSES: may help transport seeds of some forest plants; all birds are parasitized by certain microscopic organisms, and feather lice.

Waxwings

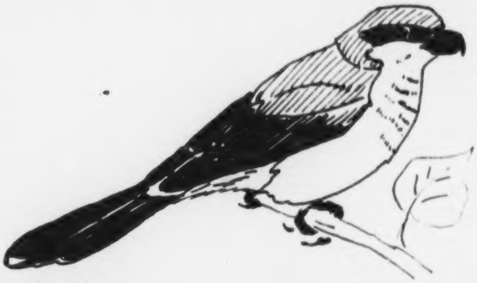


Length: 14 - 15.5 cm

Waxwings **Animal**

TRAITS: medium-sized light brown bird with crest on head, short bill, bright yellow and orange markings
HABITAT: nests in open black spruce forests and muskegs in conifer trees; feeds in all types of forest
FOODS: blueberries, cranberries, and other berries, also flying insects, such as flies, butterflies, wasps, dragonflies, true bugs, beetles and others
EATEN BY: merlin, hawk owl, sharp-shinned hawk
SYMBIOSES: may carry seeds of some berry-producing plants; parasitized by certain invertebrates and microscopic organisms.

Northern Shrike

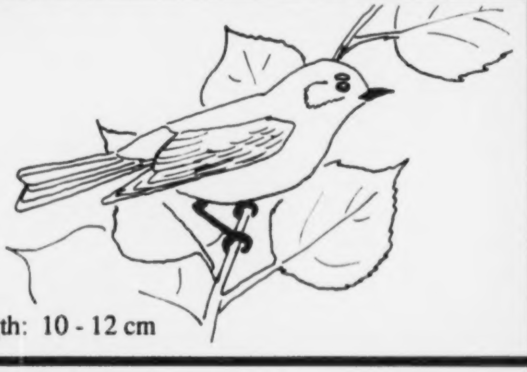


Length: 21 cm

Northern Shrike **Animal**

TRAITS: medium-sized gray bird with black mask; sharply hooked bill, long claws
HABITAT: tall shrub thickets, forest openings and edges.
FOODS: small birds and mammals, large insects; chickadees, warblers, small thrushes, kinglets, voles, shrews, grasshoppers, beetles, butterflies
EATEN BY: merlins, sharp-shinned hawks
SYMBIOSES: parasitized by certain invertebrates and microscopic organisms.

Warblers

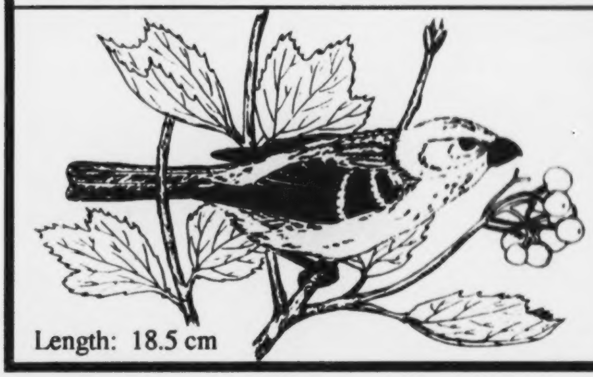


Length: 10 - 12 cm

Warblers **Animal**

TRAITS: small birds with thin bills, most have yellow markings
HABITAT: some species (orange-crowned, yellow, Wilson's, blackpoll) live in tall shrub thickets; yellow-rumped warblers live in mixed forest, while Townsend's warblers require coniferous forest.
FOODS: insects that live on leaves and twigs of trees and shrubs, such as true bugs, leafhoppers, moth and butterfly larvae, aphids, flies,beetles, sawflies, spiders
EATEN BY: merlin, sharp-shinned hawks, shrikes.
SYMBIOSES: parastized by certain invertebrates (like feather lice) and some microscopic organisms.

Pine Grosbeak



Length: 18.5 cm

Pine Grosbeak **Animal**

TRAITS: medium-sized bird with long tail; stout, cone-shaped bill; males are red, females are gray with gold markings
HABITAT: young to old coniferous and mixed hardwood-conifer forests; nests in conifer trees.
FOODS: buds, seeds, and berries of trees and shrubs.
EATEN BY: sharp-shinned hawk, merlin, goshawk.
SYMBIOSES: parasitized by certain invertebrates and microscopic organisms; may carry and spread seeds of some berry-producing plants

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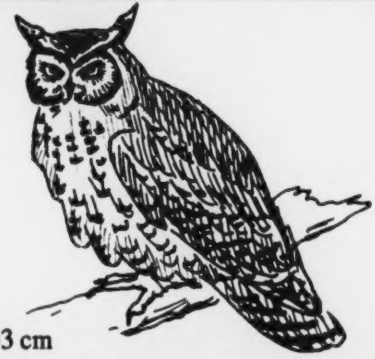
Great Horned Owl

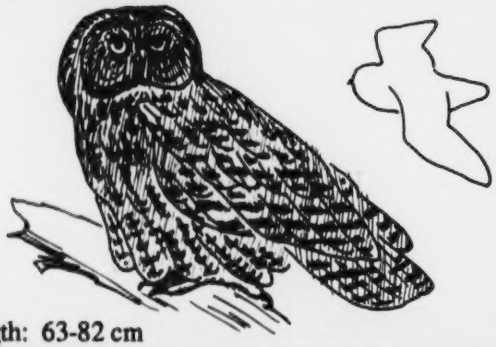


Length: 45-63 cm

Great Horned Owl **Animal**

TRAITS: large brown bird with large forward facing eyes; feathers that stick up on its head look like horns; sharp talons and hooked bill
HABITAT: mature and old forests throughout Alaska
FOODS: small mammals, including hares, squirrels, voles, mice, weasels, mink, porcupines, and grouse.
EATEN BY: no predators known
SYMBIOSES: sometimes uses the abandoned nests of goshawks; parasitized by lice and some microscopic organisms

Great Gray Owl

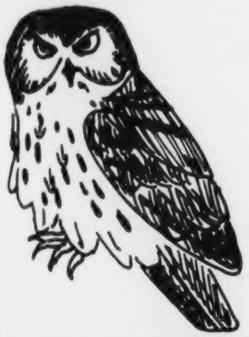


Length: 63-82 cm

Great Gray Owl **Animal**

TRAITS: large gray bird with forward facing eyes, rounded head, sharp talons and hooked bill
HABITAT: boreal forest mosaic; nests in old trees but feeds in open areas including early successional stages, muskegs, and along rivers.
FOODS: snowshoe hares, voles, squirrels
EATEN BY: no predators known
SYMBIOSES: parasitized by lice and some microscopic organisms

Boreal Owl

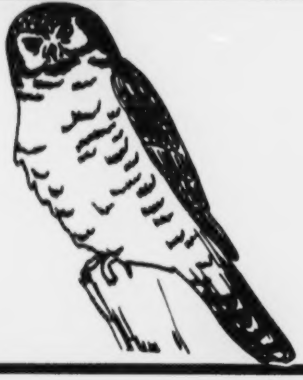


Length: 25 cm

Boreal Owl **Animal**

TRAITS: small brown bird with large, forward-facing eyes; rounded head, streaked breast, short tail
HABITAT: mixed spruce-hardwood forests; nests in holes in trees
FOODS: voles, small birds including chickadees, warblers, and thrushes.
EATEN BY: eggs may be eaten by squirrels
SYMBIOSES: depends upon woodpeckers and/or fungi to create the holes in dead trees that it needs for nesting; parasitized by feather lice and some microscopic organisms.

Northern Hawk-Owl

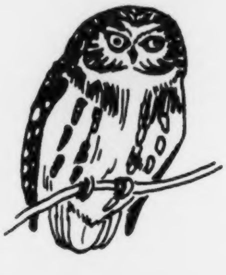


Length: 40 cm

Northern Hawk-Owl **Animal**

TRAITS: medium-sized gray-brown bird with large, forward-facing eyes, rounded head, barred breast and long tail
HABITAT: recently burned areas with large vole populations and old black spruce forests; nests in the tops of broken-off birch or spruce trees
FOODS: small mammals, including voles, and small birds such as sparrows.
EATEN BY: no predators known
SYMBIOSES: depends upon fungi to rot standing birch or spruce trees; when the rotten tops fall off, these provide a nest site for this owl; parasitized by lice and some microscopic organisms

Northern Saw-whet Owl

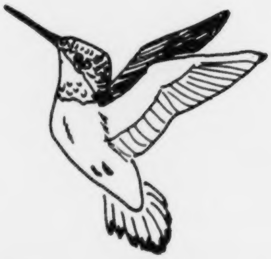


Length: 19 cm

Northern Saw-whet Owl Animal

TRAITS: small brown bird with large, forward facing eyes, long talons, and hooked bill; streaked breast;
HABITAT: old-growth coastal forest; nests in holes in dead trees.
FOODS: mainly small mammals like voles and mice; also large insects (beetles), and small birds (warblers, chickadees)
EATEN BY: none known
SYMBIOSES: depends on woodpeckers and/or fungi to create the holes in dead trees that it needs to nest and roost. Feather lice and certain microscopic organisms are parasites

Rufous Hummingbird

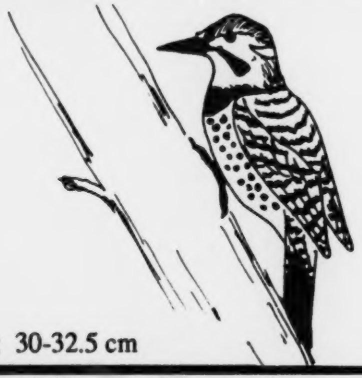


Length: 7.5-8 cm

Rufous Hummingbird Animal

TRAITS: smallest bird in Alaska; long bill with long, brush-tipped tongue, able to fly backwards
HABITAT: openings in coastal forest where salmonberry and other flowers are available; usually nests on a conifer tree branch
FOODS: mainly flower nectar and pollen; also insects
EATEN BY: eggs or young may be eaten by squirrels
SYMBIOSES: Hummingbirds help many plants, like salmonberry, by carrying their pollen between flowers, the hummingbirds get flower nectar and some pollen to eat from the flowers they pollinate. Feather lice and some micro-organisms are parasites on hummingbirds.

Northern Flicker

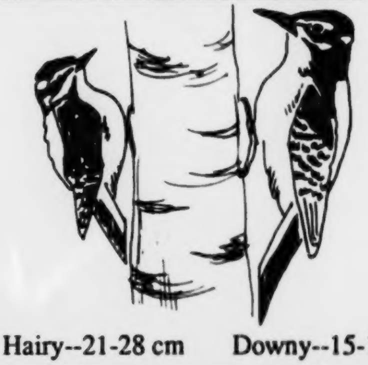


Length: 30-32.5 cm

Northern Flicker Animal

TRAITS: medium-sized bird with chisel-shaped bill, long tongue, and stiff tail feathers; bright yellow on the underside of its wings; black bars across light brown back
HABITAT: open forests and early successional stages that contain standing dead trees
FOODS: insects that live beneath the bark of trees, (such as bark beetles) and some that live in the ground, including ants
EATEN BY: goshawk, sharp-shinned hawk
SYMBIOSES: These birds dig holes in dead trees for nesting and roosting; the trees must first be decayed by fungi; their holes provide homes for other cavity-nesting birds and squirrels.

Hairy and Downy Woodpeckers

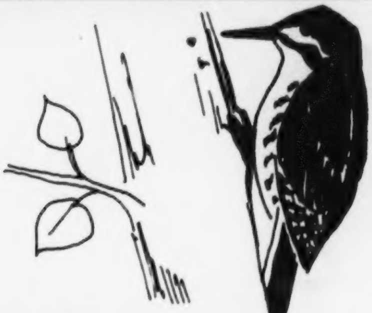


Lengths: Hairy--21-28 cm Downy--15-18 cm

Hairy and Downy Woodpeckers Animal

TRAITS: Birds with chisel-shaped bills, stiff tails; white stripe on the back, black and white markings on the face; red patch on the back of male's head
HABITAT: hardwood or coniferous forests, and early succesional stages that contain dying and dead trees
FOODS: Insects that live beneath tree bark, such as bark and longhorn beetles, horntails, and others.
EATEN BY: merlin, sharp-shinned hawk
SYMBIOSES: These birds dig holes in dead trees for nesting and roosting: the trees must first be partly decayed by fungi; their holes later provide homes for other cavity-nesting birds and squirrels.

Black-backed Woodpecker

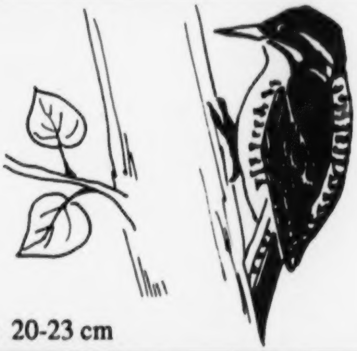


Length: 23.5- 25 cm

Black-backed Woodpecker **Animal**

TRAITS: medium-sized bird with a black back, chisel-shaped bill, long, brush-tipped tail; yellow crown on males.
HABITAT: recent burns, and forest openings with dead and dying trees.
FOODS: insects that live beneath the bark of dead and dying trees
EATEN BY: goshawks, great horned owls
SYMBIOSES: these birds dig holes in dead trees for nesting and roosting; the trees must first be decayed by fungi; their holes provide homes for other cavity-nesting birds and squirrels. Feather lice and certain microscopic organisms are parasites.

Three-toed Woodpecker

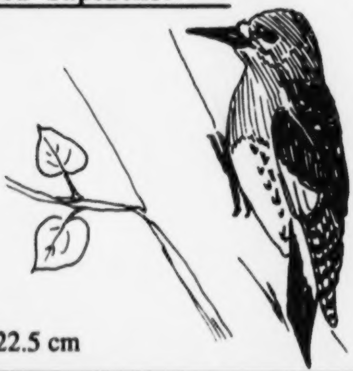


Length: 20-23 cm

Three-toed Woodpecker **Animal**

TRAITS: medium-sized bird with chisel-shaped bill, stiff tail feathers; their back is barred with black and white; males have a yellow crown
HABITAT: old forests and recently burned forests with many dead and dying trees.
FOODS: insects that live beneath tree bark, such as bark beetles, longhorn beetles, horntails and others
EATEN BY: sharp-shinned hawks, goshawks
SYMBIOSES: These birds dig holes in dead trees for nesting and roosting; the trees must first be decayed by fungi; their holes provide homes for other cavity-nesting birds and squirrels. Lice and certain microscopic organisms are parasites

Red-breasted Sapsucker

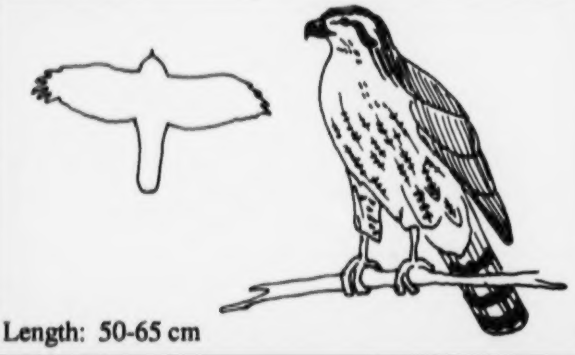


Length: 20-22.5 cm

Red-breasted Sapsucker **Animal**

TRAITS: medium-sized bird with chisel-shaped bill, reddish head and breast
HABITAT: coastal rain forest sites that contain many large dead and dying trees.
FOODS: insects that live beneath the bark of dying and dead trees, such as bark beetles, longhorn beetles, horntails, and others
EATEN BY: sharp-shinned hawks, goshawks, saw-whet owls
SYMBIOSES: These birds dig holes in dead trees for nesting and roosting; the trees must first be decayed by fungi; their holes provide homes for other cavity-nesting birds and squirrels.

Goshawk

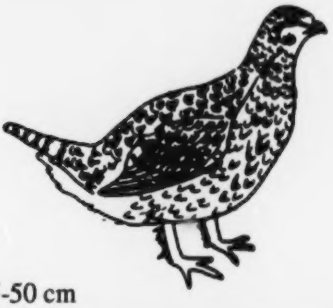


Length: 50-65 cm

Goshawk **Animal**

TRAITS: large gray bird with long tail and rounded wings; sharp talons and hooked bill
HABITAT: mixed conifer-hardwood forests with large, old trees for nest sites
FOODS: Squirrels, grouse, large songbirds, woodpeckers, weasel
EATEN BY: none known
SYMBIOSES: its nests are often used by other birds, such as great horned owls and ravens; feather lice and certain microscopic organisms are parasites

Sharp-tailed Grouse

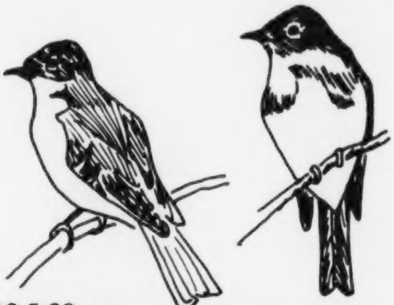


Length: 37.5-50 cm

Sharp-tailed Grouse **Animal**

TRAITS: chicken-like bird with short, stiff tail and V-shaped marks on breast
HABITAT: tall shrub thickets of boreal forest
FOODS: leaves, shoots, buds, seeds and berries of shrubs and ground-cover plants.
EATEN BY: goshawks, great horned owls, great gray owls, foxes, lynx, coyotes.
SYMBIOSES: may transport seeds of berry-producing plants. All birds are parasitized by certain microscopic organisms and feather lice.

Flycatchers

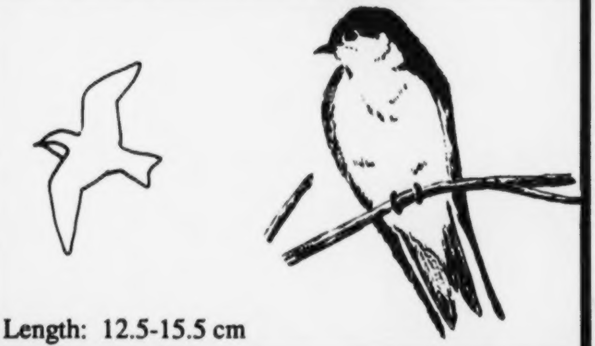


Length: 12.5-20 cm

Flycatchers **Animal**

TRAITS: small birds with upright posture, long tail, and large mouths; they sit in one spot then fly out to snap up flying insects from mid-air
HABITAT: different species require different habitats; alder and olive-sided flycatchers, and western wood peewees need tall shrub thickets; Hammond's flycatchers live only in mature boreal forest; western flycatchers live in coastal forest.
FOODS: flying insects including flies, moths, bees, butterflies, wasps, and others
EATEN BY: merlin, sharp-shinned hawk, small owls
SYMBIOSES: all birds are parasitized by certain microscopic organisms and feather lice.

Tree and Violet-green Swallows

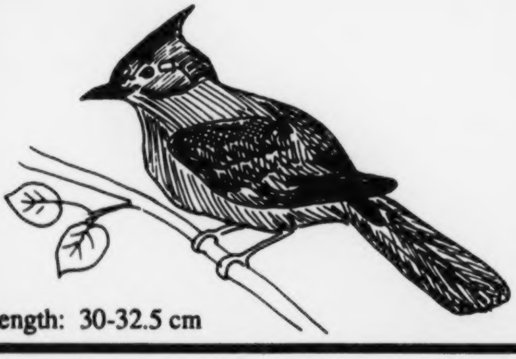


Length: 12.5-15.5 cm

Tree and Violet-green Swallows **Animal**

TRAITS: small birds with long wings, slightly to deeply forked tail; fly continuously to search for and capture flying insects
HABITAT: both species require holes in dead trees for nesting, but feed in forest openings and edges.
FOODS: flying insects, such as leafhoppers, moths, beetles, flies, dragonflies, bees, wasps
EATEN BY: merlins, sharp-shinned hawks, hawk owls; squirrels may eat eggs
SYMBIOSES: These birds depend upon fungi and woodpeckers to form the holes in dead trees that they need for nesting. All birds are parasitized by certain microscopic organisms and feather lice.

Steller's Jay



Length: 30-32.5 cm

Steller's Jay **Animal**

TRAITS: medium-sized dark blue and black bird with long tail and short bill.
HABITAT: mainly coastal rain forest, including openings and edges during summer.
FOODS: seeds and berries of trees and shrubs, wasps,beetles, bees, grasshoppers, caterpillars, moths; spiders; eggs or young of birds, frogs, newts
EATEN BY: sharp-shinned hawk, goshawk,
SYMBIOSES: Jays sometimes follow predators around, or are attracted by predator activities; they then feed on the scraps left by predators. All birds are parasitized by certain microscopic organisms, feather lice, and other invertebrate animals.

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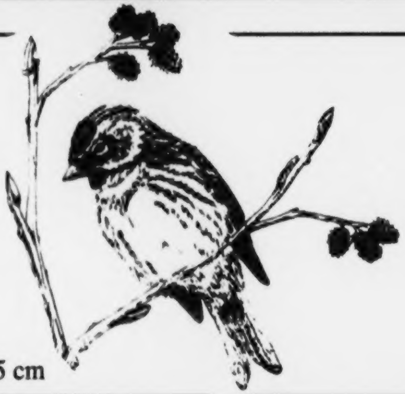
Redpolls

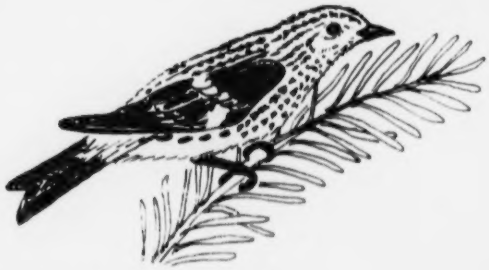


Length: 12.5 cm

Redpolls **Animal**

TRAITS: small bird with red cap, stout, cone-shaped bill
HABITAT: tall shrub thickets, mixed hardwood-conifer forests; nests in alder or willow shrub
FOODS: mainly seeds and buds of willow, aspen, birch, alder, and other plants; also insects
EATEN BY: merlin, boreal owl, sharp-shinned hawk, shrike; weasels and squirrels may prey on eggs
SYMBIOSES: parasitized by certain invertebrate animals and microscopic organisms

Pine Siskin

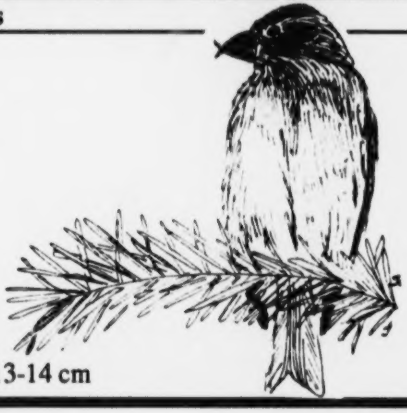


Length: 10.5 cm

Pine Siskin **Animal**

TRAITS: small bird with stout, cone-shaped bill; yellow in the wings and at base of tail
HABITAT: mature coniferous forests, occurs mainly in old coastal forest; usually nests on a branch of a conifer
FOODS: seeds of conifers, alder, birch; also moth and butterfly larvae, aphids.
EATEN BY: sharp-shinned hawk, boreal owl; eggs may be eaten by squirrels
SYMBIOSES: parasitized by some invertebrates (such as feather lice) and some microscopic organisms.

Crossbills

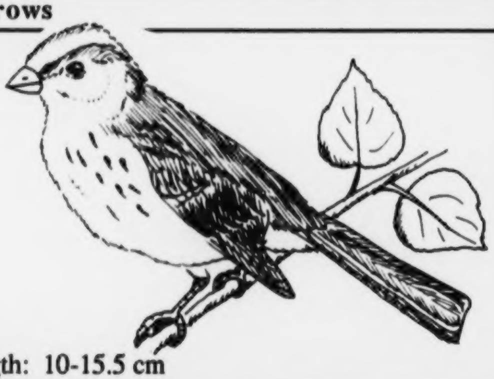


Length: 13-14 cm

Crossbills **Animal**

TRAITS: medium-sized bird with slightly forked tail; bill crosses at tip; males are reddish, females are yellowish.
HABITAT: mature and old-growth conifer forests
FOODS: seeds of conifers
EATEN BY: sharp-shinned hawk, boreal owl, saw-whet owl; squirrels may eat eggs and young
SYMBIOSES: parasitized by some invertebrates and microscopic organisms

Sparrows

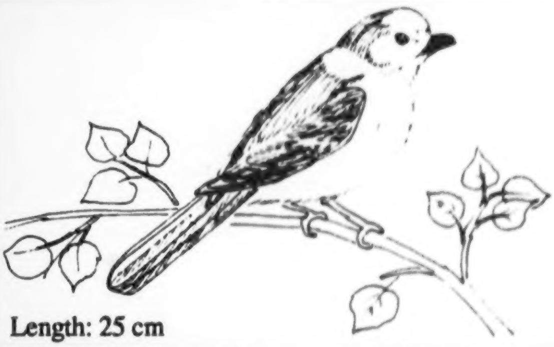


Length: 10-15.5 cm

Sparrows **Animal**

TRAITS: small birds with stout, cone-shaped bills, most are brown on the back and light underneath, many have streaks on the breast
HABITAT: tall shrub thickets, forest edges.
FOODS: mainly seeds of groundcover plants and tall shrubs; also, insects that live on these plants.
EATEN BY: sharp-shinned hawks, merlins, hawk owls, shrikes; shrews, squirrels, weasels prey on eggs and young.
SYMBIOSES: sparrows often use hair from moose, or feathers from other birds to line their nests; parasitized by certain invertebrates and microscopic organisms.

Gray Jay

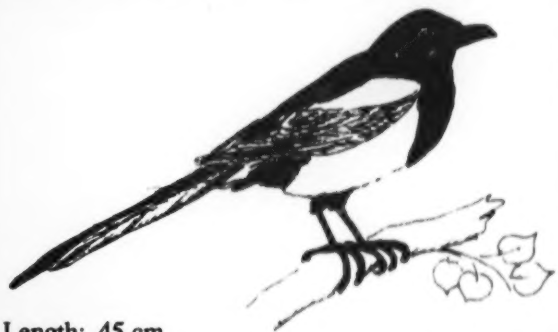


Length: 25 cm

Gray Jay **Animal**

TRAITS: medium-sized gray bird with long tail and rounded wings, slightly hooked bill.
HABITAT: mature and old forests and forest openings; more common in boreal forest
FOODS: a variety of foods, such as eggs and young of other birds, small mammals, insects and other invertebrates, berries, dead animals.
EATEN BY: sharp-shinned hawk, merlin, hawk owl
SYMBIOSES: feeds on scraps left by larger predators; feather lice, certain other invertebrates and microscopic organisms are predators.

Black-billed Magpie

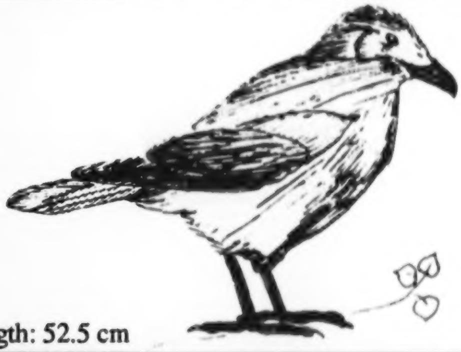


Length: 45 cm

Black-billed Magpie **Animal**

TRAITS: large black and white bird with long tail, large, stout bill
HABITAT: Builds a domed stick nest in spruce or hardwood trees of young to old boreal forest; feeds in the forest and in openings.
FOODS: eggs and young of other birds, small mammals, insects and other invertebrates, berries, dead organisms.
EATEN BY: squirrels, weasels, or marten may occasionally eat its eggs or young
SYMBIOSES: abandoned nests of this bird are sometimes used by other birds, including merlins

Common Raven

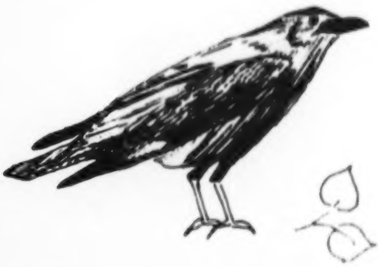


Length: 52.5 cm

Common Raven **Animal**

TRAITS: large black bird with wedge-shaped tail, broad wings; sharp talons and heavy bill
HABITAT: forests, shrublands, tundra, wetlands; builds a stick nest on cliffs or in trees.
FOODS: dead animals, eggs and young of other birds, hawks and owls; small mammals, berries.
EATEN BY: eggs may occasionally be taken by crows, marten, jays, or other predators
SYMBIOSES: may follow predators around to feed on scraps left after their kills; sometimes nests in old nests of magpies, goshawks, peregrines, red-tailed hawks, eagles, great horned owls or other large birds.

Northwestern Crow



Length: 36 cm

Northwestern Crow **Animal**

TRAITS: medium-sized black bird with medium-length, square tail, heavy bill
HABITAT: coastal forest; nests in dense thickets of alder, spruce, or hemlock trees, feeds along the shoreline.
FOODS: invertebrates such as mussels and limpets, dead organisms, eggs and young of other birds; small mammals.
EATEN BY: great horned owls, goshawks, ravens, jays and squirrels may eat their eggs.
SYMBIOSES: parasitized by a variety of invertebrate and microscopic organisms.

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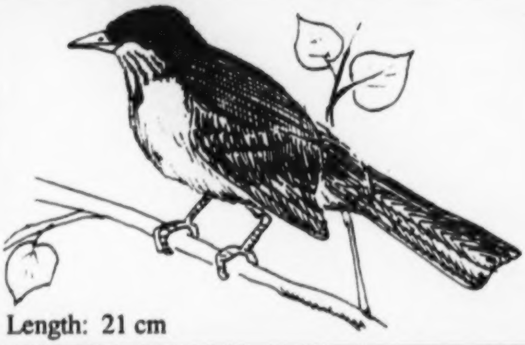
American Robin

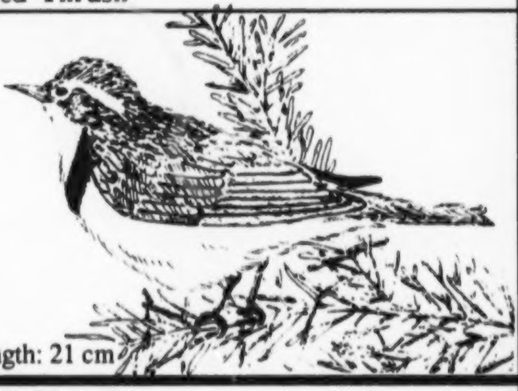


Length: 21 cm

American Robin **Animal**

TRAITS: medium-sized bird with long tail, short, thin bill; gray on back, reddish breast
HABITAT: needs open areas with many ground-cover plants as feeding areas and songposts and nest sites in tall shrubs, or live or dead trees
FOODS: insects and other invertebrates that live in the soil, such as beetles, grasshoppers, ants, caterpillars, worms and berries.
EATEN BY: goshawks, sharp-shinned hawks, merlins.
SYMBIOSES: may transport seeds of berry-producing plants. Parasitized by certain invertebrates and microscopic organisms.

Varied Thrush

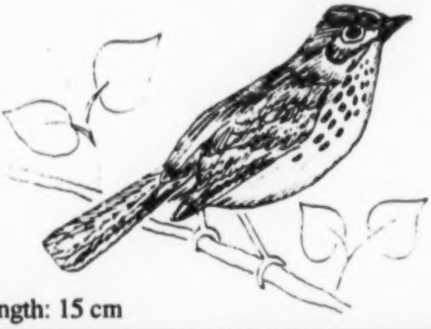


Length: 21 cm

Varied Thrush **Animal**

TRAITS: medium-sized bird with long tail, short, thin bill; gray on back, reddish underneath with black V on breast;
HABITAT: coniferous and mixed hardwood-conifer forests; nests only in conifer trees, but feeds mainly on the forest floor
FOODS: beetles, ants,bees, wasps, bugs, flies, caterpillars, grasshoppers, spiders, snails, worms, millipedes and other invertebrates; also berries
EATEN BY: merlins, sharp-shinned hawks, goshawks, red squirrels prey on eggs
SYMBIOSES: parasitized by certain invertebrate and microscopic organisms.

Small Thrushes

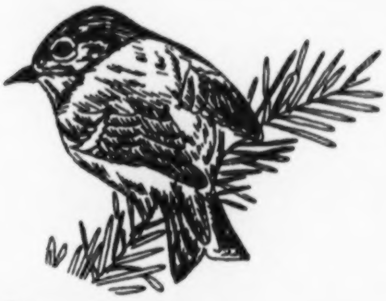


Length: 15 cm

Small Thrushes **Animal**

TRAITS: small birds with long tails, short, thin bills, brown backs, spots on white breast
HABITAT: varies by species; gray-cheeked thrushes need tall shrub thickets, hermit thrushes need forest openings and edges, while Swainson's thrushes need old conifer or hardwood forests.
FOODS: beetles, ants, wasps, moth and butterfly larvae, flies, treehoppers, millipedes, snails, and other invertebrates; also berries
EATEN BY: merlins, sharp-shinned hawks, goshawks, boreal owls, red squirrels prey on eggs.
SYMBIOSES: parasitized by certain invertebrates and microscopic organisms.

Kinglets

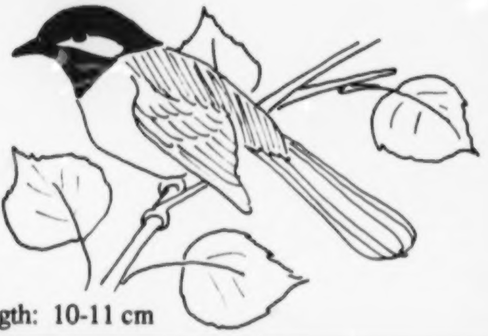


Length: 8-9 cm

Kinglets **Animal**

TRAITS: tiny birds with short thin bill and short tail; males have brightly colored crowns
HABITAT: mature and old-growth forests; ruby-crowned kinglets prefer mixed hardwood-conifer forest, while golden-crowned kinglets use mainly old coastal forest. Golden-crowns use mainly high volume old-growth coastal forest in winter.
FOODS: insects that live on the leaves of trees and tall shrubs; true bugs, moth and butterfly larvae, aphids,wasps, ants, beetles, spiders
EATEN BY: merlin, sharp-shinned hawk
SYMBIOSES: parasitized by certain invertebrates and microscopic organisms.

Chickadees

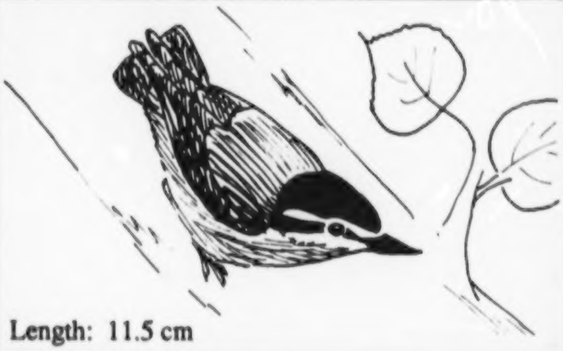


Length: 10-11 cm

Chickadees **Animal**

TRAITS: small gray to brown bird with thin bill, long tail, dark cap and chin
HABITAT: all species require trees with holes; boreal chickadees need mature to old boreal forest; black-capped use hardwood, or mixed forest; chestnut-backed use old coastal forest.
FOODS: mainly insects from leaves, bark or branches (thrips, moths, butterflies, lacewings, flies, wasps, spiders, etc.) also seeds and berries
EATEN BY: any small hawk or owl, shrikes
SYMBIOSES: require dead trees with nest holes made by woodpeckers or fungi. Certain microscopic organisms and feather lice are parasites.

Brown Creeper

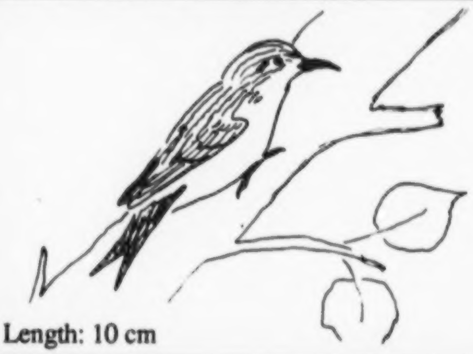


Length: 11.5 cm

Brown Creeper **Animal**

TRAITS: small brown bird with thin, curved bill and stiff tail feathers
HABITAT: requires many dead and dying trees for feeding and nesting. Nests behind bark that has peeled away from the trunk of a dead tree.
FOODS: insects that live in and under the bark of dead and dying trees (beetles, moths, flies, and others); inches its way up the trunk and out branches of dead trees to search crevices for insects.
EATEN BY: sharp-shinned hawk, boreal owl
SYMBIOSES: parasitized by some invertebrate and microscopic organisms.

Red-breasted Nuthatch

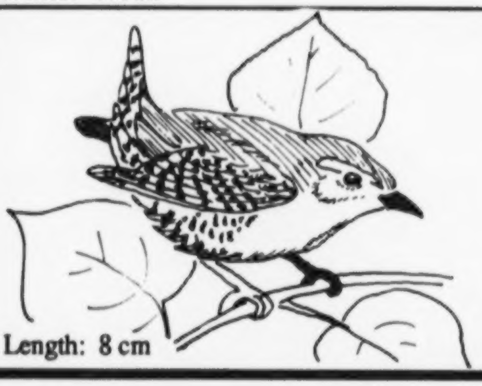


Length: 10 cm

Red-breasted Nuthatch **Animal**

TRAITS: small bird with short-tail and chunky body; short thick bill, dark gray on top, reddish underneath; often hangs upside down and travels down tree trunks head-first
HABITAT: old-growth coniferous forests; requires large, dead trees with holes for nesting.
FOODS: insects that live on the bark of trees, and seeds of spruce and other conifers.
EATEN BY: sharp-shinned hawk, boreal owl.
SYMBIOSES: depends upon woodpeckers and fungi to form the holes in dead trees that it needs for nesting; parasitized by certain feather lice and microscopic organisms.

Winter Wren

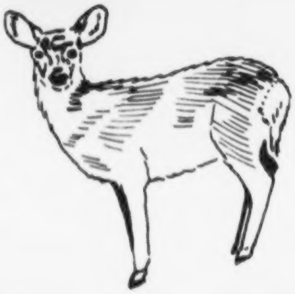


Length: 8 cm

Winter Wren **Animal**

TRAITS: small brown bird that holds its short tail upright over its back, thin bill
HABITAT: coastal forest habitats that include a lot of shrubs and ground-cover plants; needs old-growth forest during winter
FOODS: beetles, sawflies, ants, caterpillars, aphids, lacewings, and other insects, spiders, mites, and other tiny animals that live on or near the forest floor
EATEN BY: sharp-shinned hawks, boreal and saw-whet owls; shrews and squirrels may prey on eggs and young.
SYMBIOSES: parasitized by certain invertebrates (such as feather lice), and microscopic organisms.

Sitka Black-tailed Deer

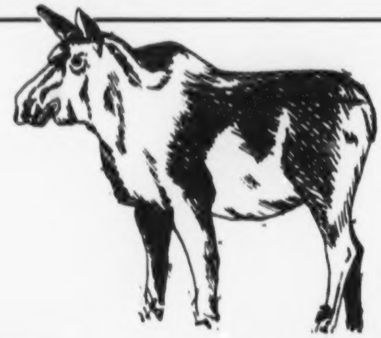


Length: 142-152 cm Weight: 36-54 kg

Sitka Black-tailed Deer **Animal**

TRAITS: small hoofed mammal, long legs, reddish brown fur, black tail, antlers on male in fall
HABITAT: coastal hemlock spruce forest; old-growth forest is critical habitat needed for winter survival.
FOODS: herbs and shrubs such as bunchberry and trailing bramble; blueberry, hemlock and arboreal lichens are also eaten in winter, but deer can not survive for a long period of time on a diet of these alone
EATEN BY: wolves, brown bears, humans
SYMBIOSES: depend upon bacteria that live in their digestive tract to help them digest plant tissues.

Moose

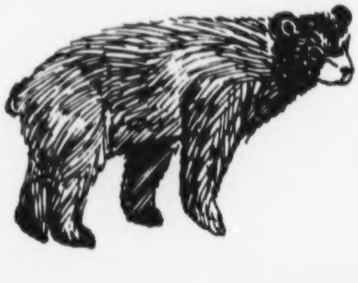


Length: 318 cm Weight: 414-549 kg

Moose **Animal**

TRAITS: large, hoofed mammal; long legs, drooping nose, large palmate antlers on male in fall.
HABITAT: prefers tall shrub thickets found 10-30 years after a forest fire, or other disturbance, and thickets along rivers; also seeks shelter in forest, particularly during winters with heavy snowfall
FOODS: browses on woody vegetation, especially willow, birch, and aspen year-round. In spring, grasses, sedges, horsetails, and aquatic plants are eaten
EATEN BY: wolves, brown bears and humans.
SYMBIOSES: depend upon bacteria that live in their digestive tract to help them digest plant material; parasitized by a variety of small organisms.

Black Bear

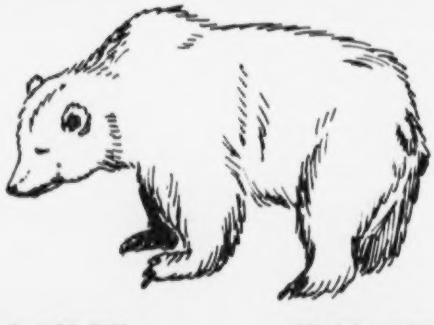


Length: 100-200 cm Weight: 40-140 kg

Black Bear **Animal**

TRAITS: mammal; brown, black or blue-gray fur; brown muzzle, short claws, sharp teeth, upper rear molar less than 3.6 cm long.
HABITAT: forested areas throughout Alaska
FOODS: varies seasonally; fresh green vegetation in spring, salmon and berries in fall; sometimes kill moose calves and deer fawns; also eat any dead animal.
EATEN BY: brown bears, black bears, humans
SYMBIOSES: parasitized by a variety of invertebrate animals, protists and monerans; often spends the winter in a tree hollow created by fungi and bacteria that decay wood

Brown Bear

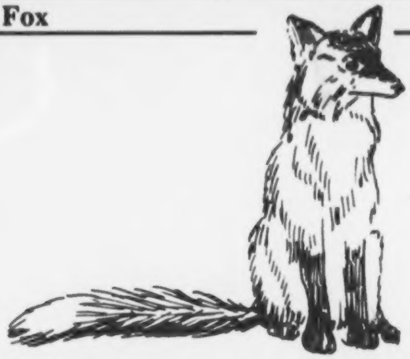


Length: 180-250 cm Weight: 147-386 kg

Brown Bear **Animal**

TRAITS: large mammal; sharp teeth, long claws on feet, large hump over shoulders, dished in face, upper rear molar over 3.6 cm long.
HABITAT: large areas of forest or tundra; each individual may use 104-390 sq km of these habitats.
FOODS: fresh green vegetation in spring; salmon and berries in fall; also young of moose, caribou, and deer; ground squirrels, and any dead animal.
EATEN BY: brown bears
SYMBIOSES: parasitized by many invertebrate animals, protists, and monerans; in coastal forest areas, some hibernate in large tree hollows created by fungi and bacteria that decay wood

Red Fox

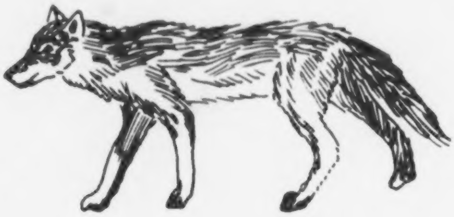


Length: 83-110 cm Weight: 3-7 kg

Red Fox **Animal**

TRAITS: dog-like mammal with long tail, sharp teeth, red to black fur, long legs
HABITAT: early successional stages of boreal forest, or tundra areas where their prey are abundant
FOODS: voles and lemmings are their preferred foods; muskrats, squirrels, hares, birds, eggs, insects, berries, and carrion (dead animals) are also eaten
EATEN BY: wolves, coyotes, lynx, wolverine, bears
SYMBIOSES: Several invertebrate animals, protists, and monerans are parasites of foxes

Coyote

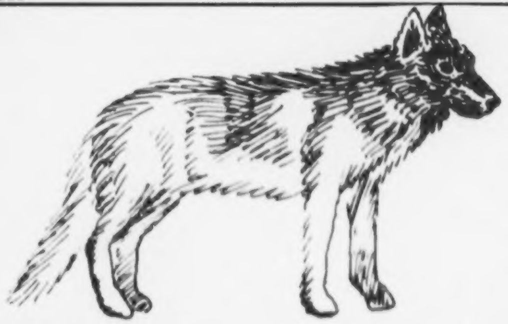


Length: 100-150 cm Weight: 11-12 kg

Coyote **Animal**

TRAITS: dog-like mammal; large sharp-pointed ears, long bushy tail, long legs, gray to brown in color
HABITAT: Open areas, including early successional seres of boreal forest, wetlands, and tundra
FOODS: hares, voles, lemmings, and carrion (dead animals) are their main foods; marmots, ground squirrels, muskrats, birds, fish, and insects are eaten occasionally
EATEN BY: great horned owls, golden eagles, wolves, bears
SYMBIOSES: parasitized by a variety of invertebrate animals, protists and monerans; scavenges scraps from wolf and bear kills of large prey

Wolf

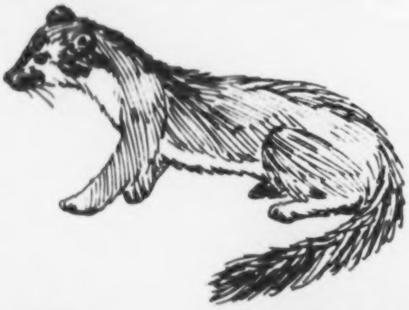


Length: 130-180 cm Weight: 18-80 kg

Wolf **Animal**

TRAITS: large, dog-like mammal, sharp teeth, long bushy tail, long legs; lives and hunts in packs
HABITAT: forests, tundra, wetlands wherever large herbivores (moose, deer, caribou, goats, or sheep) are available for food
FOODS: moose, deer, caribou, goats, and Dall sheep adults and young; also marmots, voles
EATEN BY: wolves
SYMBIOSES: parasitized by a variety of invertebrate animals, protists and monerans; smaller animals, such as foxes, weasels, ravens, and jays, often feed on scraps left by these large predators

Marten



Length: 48-62 cm Weight: 0.7-1.5 kg

Marten **Animal**

TRAITS: mammal; sharp teeth, short legs, yellow to brown fur , long tail
HABITAT: Coniferous forests; requires a high population of voles near mature coniferous trees for cover
FOODS: meadow and red-backed voles are their primary prey; berries, small birds, bird eggs, squirrels and carrion (dead animals) are eaten infrequently
EATEN BY: coyotes, red fox, lynx, eagles, great horned owls
SYMBIOSES: parasitized by a variety of invertebrate animals, protists and monerans; uses squirrel middens for winter den sites

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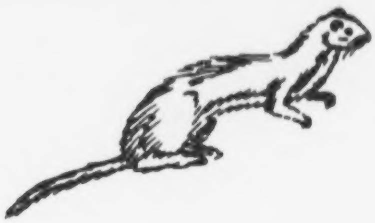
Least Weasel

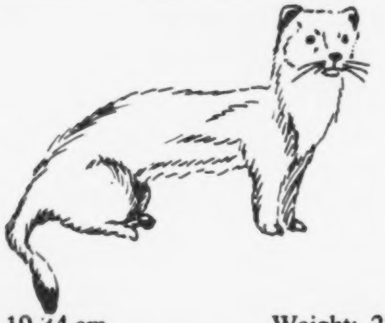


Length: 22-25 cm Weight: 28-63 gm

Least Weasel **Animal**

TRAITS: small furbearing mammal with long tail; no black tip on short tail; turns white in winter
HABITAT: early successional stages of boreal forest, or tundra areas where voles and lemmings are abundant
FOODS: voles, shrews, lemmings, jumping mice, deer mice, and other small mammals are their main foods; small birds, insects and plants are also eaten
EATEN BY: great horned owls, hawks, red foxes, goshawks, ermine
SYMBIOSES: several invertebrate animals (such as lice), and certain protists and monerans are parasites

Ermine

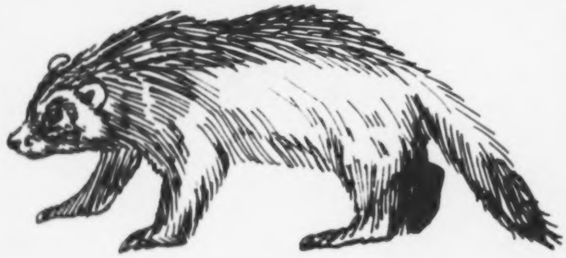


Length: 19-34 cm Weight: 28-168 gm

Ermine **Animal**

TRAITS: small furbearing mammal; sharp teeth, black tip on long tail; turns white in winter
HABITAT: open areas, including early successional stages of boreal forest, wetlands, and tundra where water is available for drinking
FOODS: voles, shrews, jumping mice, deer mice and other small mammals are the main foods; birds, insects, and plants are also eaten.
EATEN BY: great horned owls, hawks, red foxes, goshawks
SYMBIOSES: parasitized by a variety of invertebrate animals (fleas, lice, certain worms), protists and monerans

Wolverine

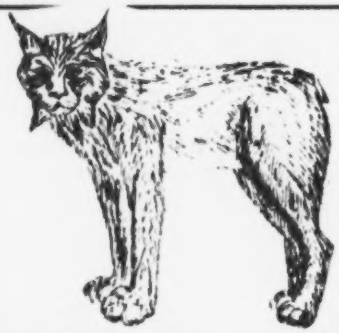


Length: 82-131 cm Weight: 14-27 kg

Wolverine **Animal**

TRAITS: furbearing mammal, brown with white stripes on back; sharp teeth
HABITAT: coastal and boreal forest, also tundra
FOODS: calves of moose and caribou, marmots, voles, bird eggs, berries, dead animals
EATEN BY: no other animals are known to prey on these animals
SYMBIOSES: parasitized by a variety of invertebrate animals (lice and certain kinds of worms), and by certain protists and monerans

Lynx

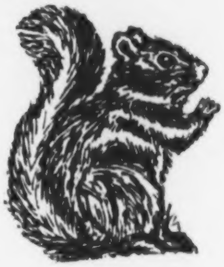


Length: 67-85 cm Weight: 4.5-14 kg

Lynx **Animal**

TRAITS: mammal with tufted ears, long legs, large feet and short tail; sharp teeth
HABITAT: require a mosaic of old conifer forest and early successional stages where prey are abundant
FOODS: eats snowshoe hares almost exclusively; when hare populations are low, lynx may also eat small mammals, birds, and rarely moose or caribou.
EATEN BY: young may be eaten by great horned owls or wolverines
SYMBIOSES: parasitized by a variety of invertebrate animals, and certain protists and monerans

Red Squirrel

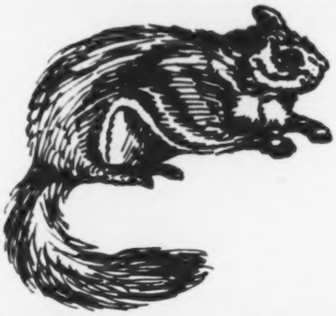


Length: 28 - 37 cm Weight: 196 -244 gm

Red Squirrel (Sciuridae) Animal

TRAITS: small mammal with long front teeth; short legs, large bushy tail; red brown on back, whitish underneath
HABITAT: coniferous forests
FOODS: mainly seeds of spruce and other conifers; berries, mushrooms; less often, bird eggs and young.
EATEN BY: marten, goshawks, great-horned owls
SYMBIOSES: when carrying and caching its food, this animal incidentally scatters seeds of spruce and berry-producing plants and the spores of mycorrhizal fungi

Northern Flying Squirrel

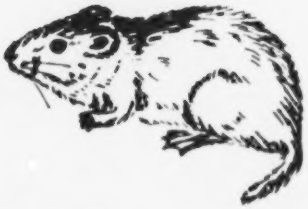


Length: 30 cm Weight : 112 -182 gm

Northern Flying Squirrel (Sciuridae) Animal

TRAITS: small mammal with long front incisors; long bushy tail, short legs connected by a folded layer of loose skin used for gliding between trees
HABITAT: requires old trees with den sites in tree cavities and witches brooms and small forest openings
FOODS: mainly mushrooms, truffles, and other fungi; lichens, berries, green vegetation, seeds, buds; also insects, and small, live or dead mammals and birds.
EATEN BY: owls, goshawk, marten
SYMBIOSES: scatters the spores of important mycorrhizal fungi, such as truffles; nests and roosts in abandoned woodpecker holes in dead trees and in witches brooms caused by a rust parasite of spruce

Voles

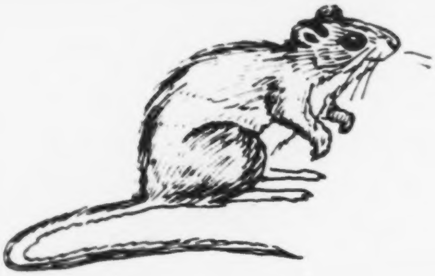


Length: 12.5 - 15 cm Weight: 14 - 168 gm

Voles (Cricetidae) Animal

TRAITS: small mammal with rounded nose, short tail, short legs; long front teeth for gnawing
HABITAT: forests, shrublands, and grassy areas
FOODS: fresh green vegetation, seeds, roots, berries, mushrooms and other fungi
EATEN BY: foxes, marten, weasels, boreal and hawk owls.
SYMBIOSES: these animals are important to many plants because they help scatter seeds and the spores of mycorrhizal fungi; the tunnels these animals dig in leaf litter and soil helps allow the soil to absorb water and air, and provide crevices in which small soil animals can live

White-footed Deer Mouse

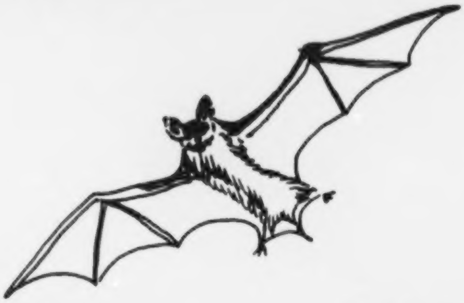


Length: 15 - 23 cm Weight: 12- 32 gm

White-footed Deer Mouse (Cricetidae) Animal

TRAITS: small mammal with long front teeth for gnawing, long tail; brown on top white underneath, large eyes
HABITAT: coastal rainforest
FOODS: seeds, berries, mushrooms and other fungi, fresh green vegetation
EATEN BY: weasels, marten, boreal and saw-whet owls.
SYMBIOSES: while eating and caching their foods, these animals scatter the seeds of some plants, and the spores of mycorrhizal fungi; their tunnels in the soil also help it to absorb moisture and air and provide crevices in which small soil animals can live

Little Brown Bat

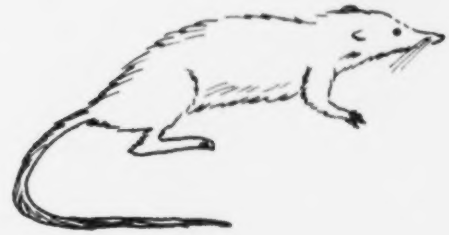


Length: 8 - 10 cm Weight: 7 - 9 gm

Little Brown Bat **Animal**

TRAITS: mammal with forelegs modified to form membranous wings; sharp teeth; active during late evening, early morning, and at night
HABITAT: forested areas; requires roosting sites in hollow dead trees, under logs, or in caves near ponds, streams, or clearings used for feeding
FOODS: flying insects are captured using echolocation; usually feeds over water and in forest openings; flies, mosquitos, moths, mayflies, caddisflies, and beetles.
EATEN BY: boreal and saw-whet owls
SYMBIOSES: certain fungi grow only in bat droppings

Shrew

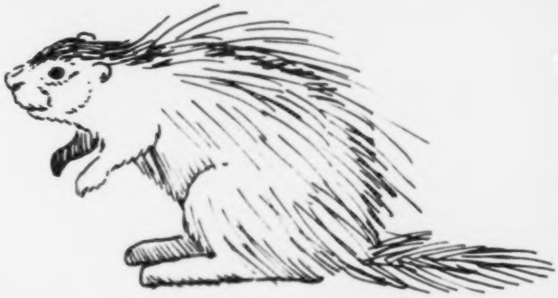


Length: 5 - 9 cm (without tail) Weight: 3 - 9 gm

Shrew **Animal**

TRAITS: small mammal with long, pointed nose sharp teeth, short legs, and long tail
HABITAT: Forests, shrublands and grasslands with lots of ground cover and insects.
FOODS: insects such as springtails, beetles, and fly larvae; also centipedes, mites, worms, tardigrades, spiders, roundworms, eggs and young of small ground-nesting birds (wrens, thrushes, sparrows), young voles
EATEN BY: owls, kestrels, weasels, marten
SYMBIOSES: the tunnels these animals dig in forest litter and soil allow water and air to seep into the soil, and provide homes for small soil animals

Porcupine

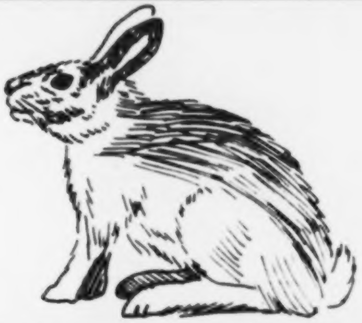


Length: 65 - 78 cm Weight: 7 - 8 kg

Porcupine **Animal**

TRAITS: mammal; large front teeth for gnawing, short legs, back and tail covered with quills
HABITAT: coniferous forests that include large hollow trees, or small caves under rocks or logs that it can use for denning
FOODS: green vegetation in spring and summer; the cambium, or inner bark, of spruce and birch in winter.
EATEN BY: lynx, coyotes, wolves, wolverine
SYMBIOSES: the wounds this animal inflicts on tree bark allow fungi, insects, and various microscopic parasites to enter trees

Snowshoe Hare

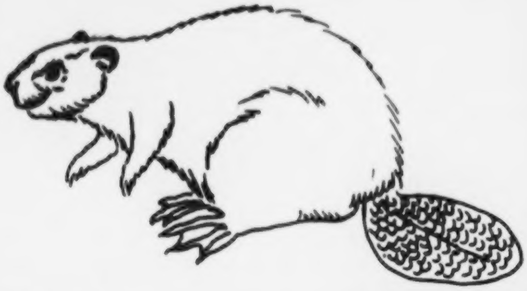


Length: 28 - 33 cm Weight: 0.9 - 1.8 kg

Snowshoe Hare **Animal**

TRAITS: small mammal with long front teeth for clipping twigs; large, long ears; short tail; long hind legs and large hind feet; changes to white in winter
HABITAT: requires a forest mosaic that includes early successional forest where branches of willows, birch, and aspen are at heights it can reach
FOODS: buds and twigs of birch, willow, and aspen
EATEN BY: lynx, goshawks, great-horned owls, red fox, coyote
SYMBIOSES: these animals depend upon microscopic organisms that live in their intestines to produce certain vitamins needed for survival

Beaver

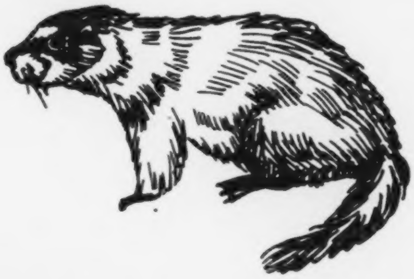


Length: 0.9-1.2 m Weight: 13.5-27 kg

Beaver **Animal**

TRAITS: small mammal with long front incisors, webbed feet, long flat tail
HABITAT: forests and shrublands near streams that do not freeze up in winter.
FOODS: the cambium (inner bark) of willow, aspen, cottonwood trees and shrubs; also aquatic plants
EATEN BY: wolves, lynx, wolverine, bears, humans
SYMBIOSES: Ponds made by these animals provide habitat for a variety of pond-dwelling wildlife, and also kill trees; the dead trees provide habitat for bark beetles, certain fungi, and woodpeckers. Several invertebrate animals, protists, and monerans are parasites on this animal.

Woodchuck

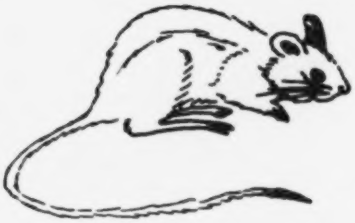


Length: 50 - 70 cm Weight: 2.3 - 4.5 kg

Woodchuck **Animal**

TRAITS: small mammal with long front teeth for gnawing, short legs, long bushy tail
HABITAT: lives along forest edges in central Alaska
FOODS: green vegetation in spring and summer; hibernates in winter
EATEN BY: lynx, coyotes, wolves
SYMBIOSES: several invertebrate and microscopic organisms are parasites on this animal

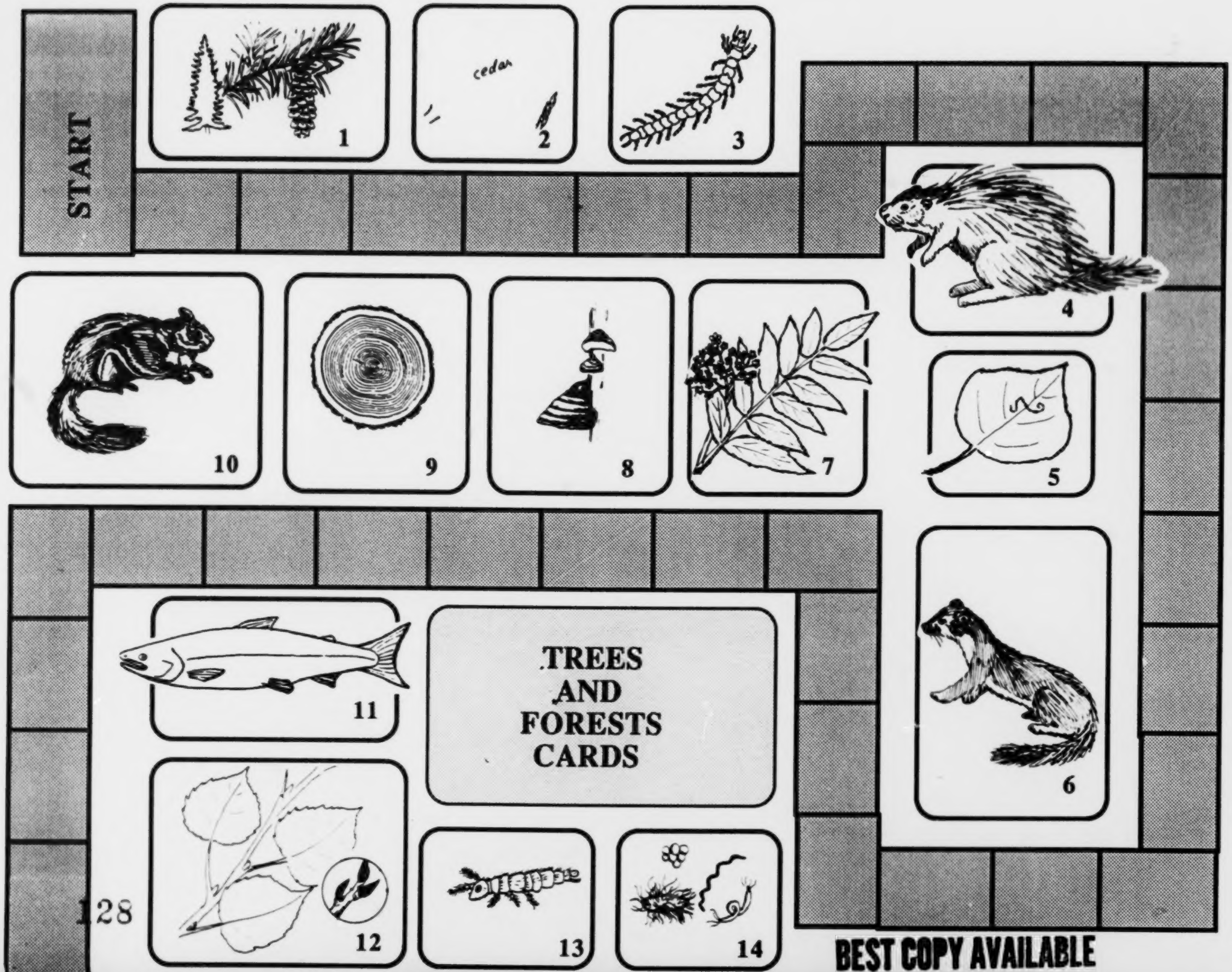
Meadow Jumping Mouse



Length: 9 - 10 cm (without tail) Weight: 14 - 23 gm

Meadow Jumping Mouse **Animal**

TRAITS: small mammals with very long tails, large hind feet, small ears, large front teeth for gnawing
HABITAT: forest edges and clearings; needs den sites beneath brush, logs, or stumps and well-drained sites to dig its deep winter burrow
FOODS: seeds, insects, fruits
EATEN BY: weasels, marten, hawk owls, boreal owls, kestrels
SYMBIOSES: while eating and caching its foods, this small mammal helps scatter seeds of some plants; its soil burrows break up the soil and allow water and air to seep in, and provide homes for small soil animals.


START
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cedar
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TREES AND FORESTS CARDS
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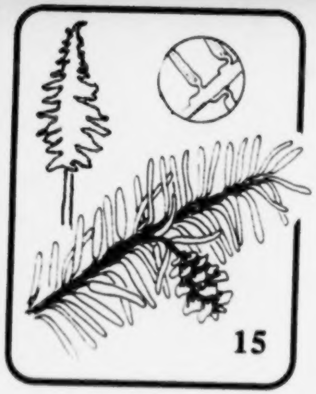
COASTAL FOREST CARDS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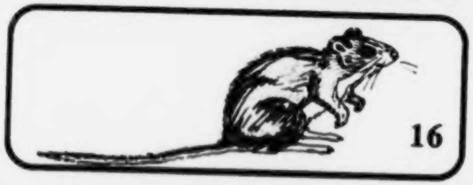
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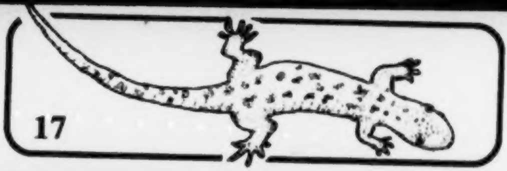
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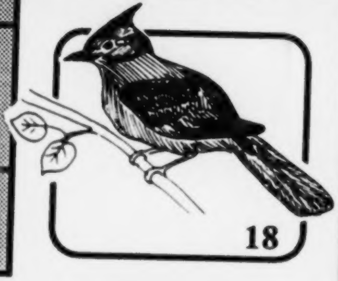
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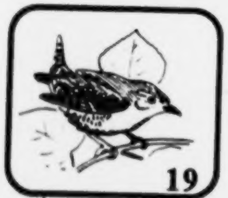
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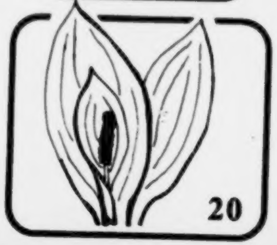
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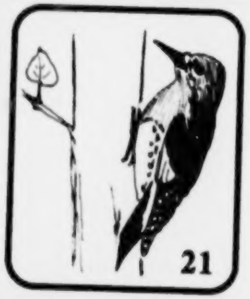
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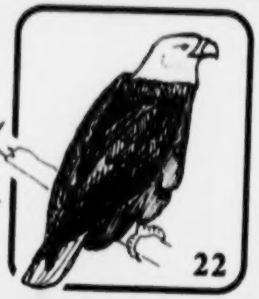
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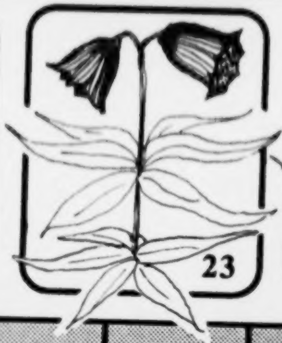
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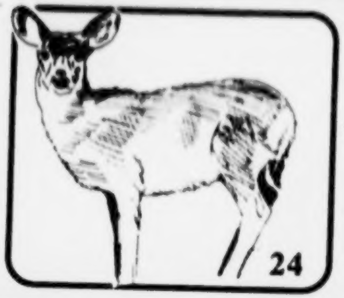
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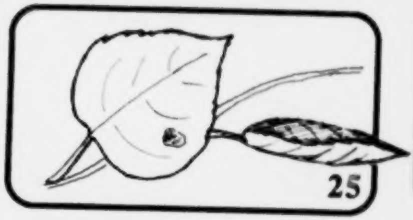
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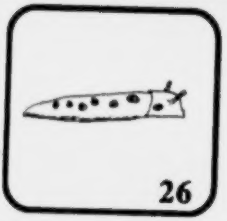
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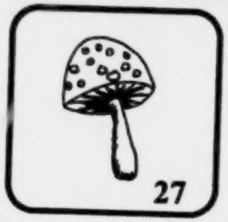
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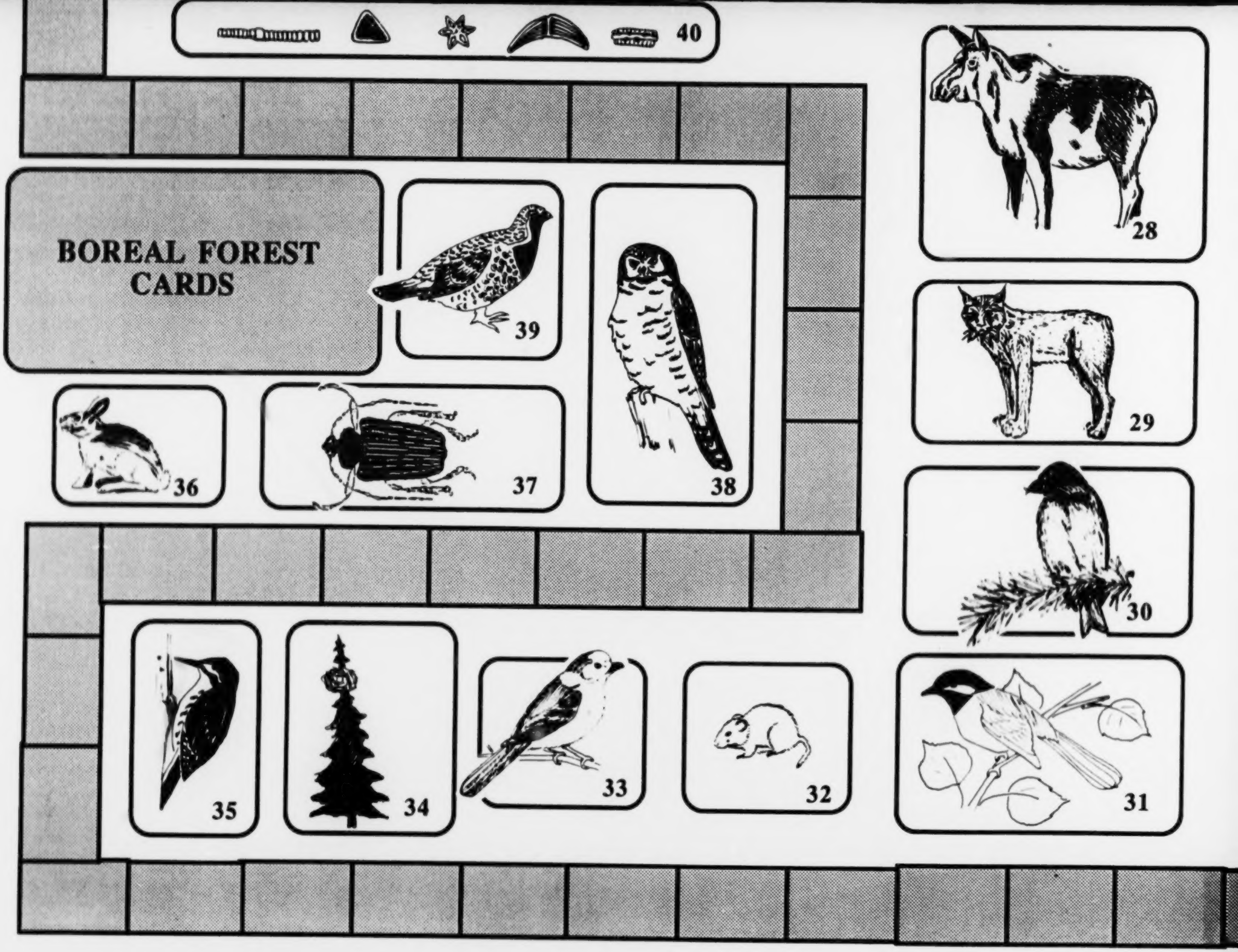
BOREAL FOREST CARDS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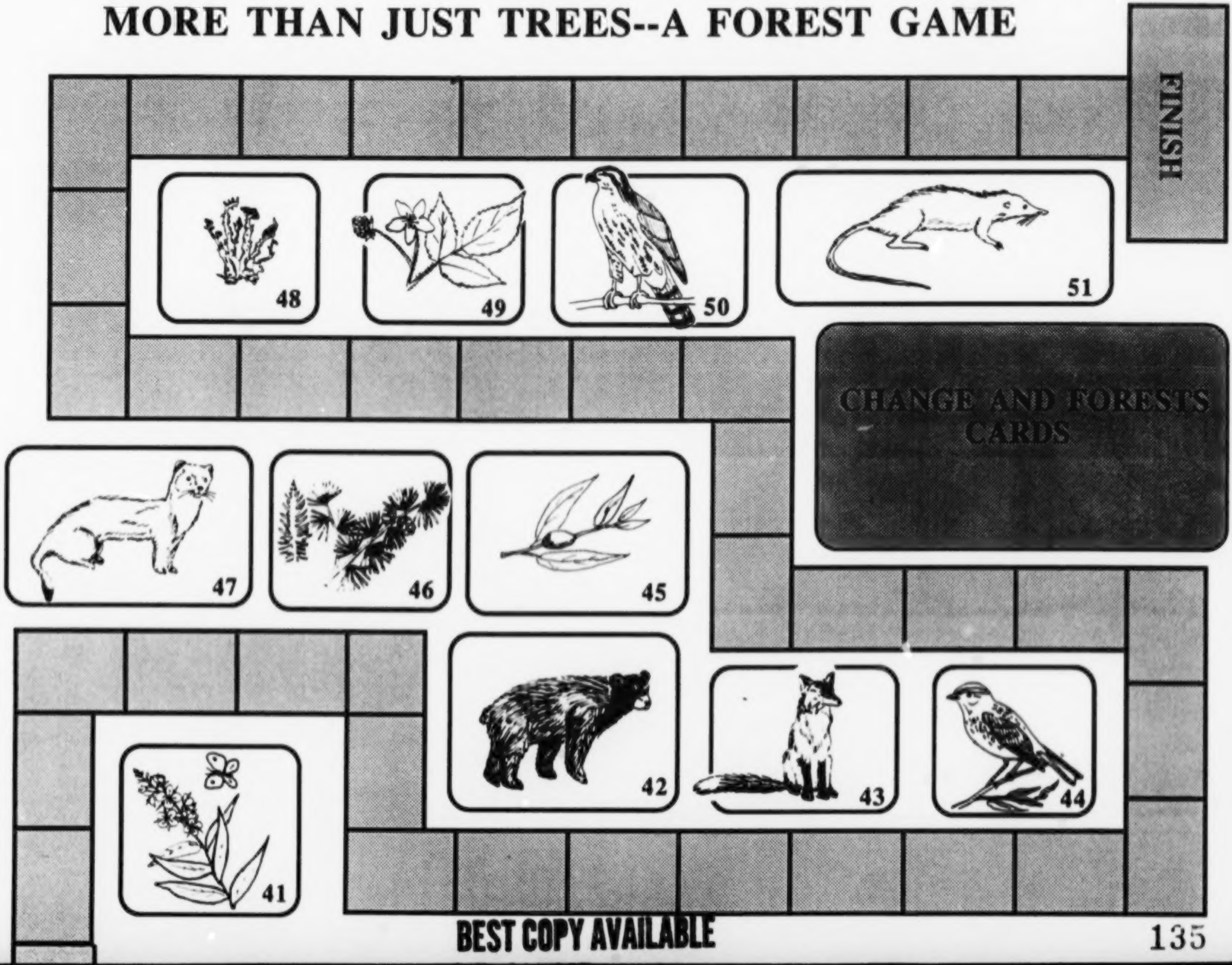
MORE THAN JUST TREES--A FOREST GAME


FINISH
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CHANGE AND FORESTS CARDS
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